

ARMY MEDICAL LIBRARY
WASHINGTON

Founded 1836



ANNEX

ANNEX

ANNEX

ANNEX

Section _____

Number 145232

GPO 3-10543

Form 113c, W. D., S. G. O.
(Revised June 13, 1936)

RETURN TO
NATIONAL LIBRARY OF MEDICINE
BEFORE LAST DATE SHOWN

JUL 30 1973

SYSTEM OF DISEASES

403186
Was
lost a
70

OF THE

EAR, NOSE, AND THROAT.

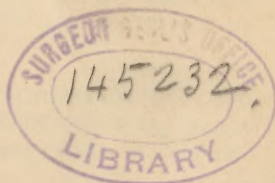
EDITED BY

CHARLES H. BURNETT, A.M., M.D.,

EMERITUS PROFESSOR OF OTOTOLOGY IN THE PHILADELPHIA POLYCLINIC; CLINICAL PROFESSOR
OF OTOTOLOGY IN THE WOMAN'S MEDICAL COLLEGE OF PENNSYLVANIA; AURAL
SURGEON TO THE PRESBYTERIAN HOSPITAL, ETC., PHILADEL-
PHIA, PA.



VOL. II.



ILLUSTRATED.

PHILADELPHIA:

J. B. LIPPINCOTT COMPANY.

LONDON: 10 HENRIETTA STREET, COVENT GARDEN.

1893.

WV
B964s
1893
v. 2

Film 7626, Item 3

COPYRIGHT, 1893,
BY
J. B. LIPPINCOTT COMPANY.

PRINTED BY J. B. LIPPINCOTT COMPANY, PHILADELPHIA, U.S.A.

CONTENTS OF VOLUME II.

PART II.

DISEASES OF THE NOSE AND NASO-PHARYNX.

(CONTINUED.)

	PAGE
MORBID GROWTHS AND DEFORMITIES OF THE NASAL CAVITIES: PATHOLOGY, ETIOLOGY, PHYSIOLOGY, AND DIFFERENTIAL DIAGNOSIS. By CARL SEILER, M.D., Lecturer on Laryngology in the University of Pennsylvania; Chief of the Throat Dispensary in the University Hospital; Late Curator of the Pathological Society, etc., Philadelphia	1
SURGICAL PROCEDURES IN DEFORMITIES AND NEOPLASTIC GROWTHS IN THE NOSE. By WILLIAM CHAPMAN JARVIS, M.D., Professor of Laryngology and Diseases of the Nose and Throat, New York University Medical College; Consulting Physician to Out-Patient Department, Bellevue Hospital; Visiting Physician to Charity Hospital, etc., New York	39
HAY-FEVER. By FRANCKE H. BOSWORTH, M.D., Professor of Throat Diseases in Bellevue Hospital Medical College, New York	66
NEUROSES OF THE NOSE AND NASO-PHARYNX. By JOSEPH A. WHITE, A.M., M.D., Senior Surgeon to the Richmond Eye, Ear, Throat, and Nose Infirmary, Richmond, Virginia	90
DISEASES OF THE EYE DEPENDENT UPON DISEASES OF THE NOSE, AND REFLEX NASAL DISEASE DUE TO OCULAR MALADIES. By GEORGE M. GOULD, A.M., M.D., Ophthalmologist to the Philadelphia Hospital	149
SKIN DISEASES OF THE NOSE. By L. DUNCAN BULKLEY, M.D., Professor of Dermatology and Syphilis, New York Post-Graduate Medical School and Hospital; Attending Physician to the New York Skin and Cancer Hospital, etc., New York	173

PART III.

DISEASES OF THE PHARYNX AND LARYNX.

ANATOMY AND PHYSIOLOGY OF THE PHARYNX AND LARYNX. By ALEXANDER W. MACCOY, M.D., Professor of Laryngology in the Philadelphia Polyclinic and College for Graduates in Medicine; Fellow of the American Laryngological Association, etc., Philadelphia, Pennsylvania	192
---	-----

	PAGE
VOCAL CULTURE AND HYGIENE. By S. HARTWELL CHAPMAN, A.M., M.D., Fellow of the American Laryngological Association; formerly Lecturer on Laryngology and Otology in Yale College, etc., etc., New Haven, Connecticut	212
ACUTE PHARYNGITIS. By MAX THORNER, A.M., M.D., Professor of Clinical Laryngology and Otology, Cincinnati College of Medicine and Surgery; Laryngologist and Aurist, Jewish Hospital; Consulting Laryngologist, Ophthalmic Hospital, etc., Cincinnati, Ohio	250
ACUTE TONSILLITIS. By C. E. BEAN, M.D., St. Paul, Minnesota	274
CHRONIC PHARYNGITIS. By E. FLETCHER INGALS, M.D., Professor of Laryngology and Practice of Medicine in Rush Medical College; Professor of Diseases of the Throat and Chest in Woman's Medical College; Professor of Laryngology and Rhinology in Chicago Polyclinic, and Laryngologist to the Presbyterian and St. Joseph's Hospitals, etc., Chicago, Illinois	284
ACUTE LARYNGITIS. By JACOB D. ARNOLD, A.M., M.D., President and Professor of Laryngology, San Francisco Polyclinic and School for Post-Graduate Instruction; Consulting Surgeon, Children's Hospital, etc., San Francisco, California	305
CROUP. By WILLIAM CARR GLASGOW, M.D., Professor of Practice of Medicine, Diseases of the Chest, and Laryngology, Missouri Medical College, St. Louis, Missouri	328
DIPHTHERIA. By J. LEWIS SMITH, M.D., Clinical Professor of Diseases of Children, Bellevue Hospital Medical College, etc., New York	343
THE SURGICAL TREATMENT OF CROUP AND DIPHTHERIA. By CHARLES B. NANCREDE, M.D., Professor of Surgery and of Clinical Surgery in the University of Michigan, Ann Arbor, Michigan	390
LUPOUS AND LEPROUS LARYNGITIS. By RAMON DE LA SOTA Y LASTRA, M.D., Ph.D., LL.D., Professor of Surgical Pathology in the Medical School of Seville; Laryngologist and Dermatologist in the Polyclinic of the same; Knight of the Royal Order of Carlos Tercero; Corresponding Member of the American Laryngological Association, etc.; Seville, Spain. Translated by DAVID CERNA, M.D., Ph.D., Late Assistant in Physiology, Demonstrator of, and Lecturer on, Experimental Therapeutics in the University of Pennsylvania; Corresponding Fellow of the Sociedad Española de Higiene of Madrid, etc.; Galveston, Texas	412
CHRONIC LARYNGITIS, SIMPLE AND TRAUMATIC. By E. L. SHURLY, M.D., Professor of Clinical Medicine and Laryngology in the Detroit College of Medicine; Chief of the Medical Staff of Harper Hospital, Laryngologist to St. Mary's Hospital, etc., Detroit, Michigan	457
FOREIGN BODIES IN THE LARYNX AND TRACHEA, AND IN THE PHARYNX AND ŒSOPHAGUS. By JOHN O. ROE, M.D., Rochester, New York, Fellow of the American Laryngological Association; Corresponding Member of the Société Française d'Otologie, de Laryngologie et de Rhinologie; Member of the British Medical Association, etc.	500
CHRONIC DISEASES OF THE TONSILS. By CHARLES H. KNIGHT, M.D., Professor of Diseases of the Throat and Nose, New York Post-Graduate Medical School; Surgeon to the Manhattan Eye and Ear Hospital, Throat Department; etc., New York	571

THE PHARYNX AND LARYNX IN THE EXANTHEMATA AND OTHER FEBRILE AFFECTIONS. By RUFUS P. LINCOLN, M.D., Member of the New York Academy of Medicine, of the American Laryngological Association, of the American Climatological Society, etc., New York City	622
NEUROSES OF THE LARYNX AND OF THE PHARYNX, AND DYS-PHAGIA. By W. PEYRE PORCHER, M.D., Lecturer on Laryngology and Rhinology and on Materia Medica and Therapeutics in the Charleston Medical School; One of the visiting Laryngologists to the City Hospital, etc., Charleston, South Carolina	669
DEFORMITIES AND MORBID GROWTHS OF THE PHARYNX AND THE LARYNX. By LENNOX BROWNE, F.R.C.S. ED., Senior Surgeon to the Central London Throat and Ear Hospital; Surgeon and Aural Surgeon to the Royal Society of Musicians; President of the British Laryngological and Rhinological Association, etc., London, England	709
TUBERCULOSIS AND SYPHILIS OF THE LARYNX. By J. SOLIS COHEN, A.M., M.D., Professor of Laryngology in Jefferson Medical College, etc., Philadelphia, Pa.	792

LIST OF ILLUSTRATIONS TO VOLUME II.

PLATES.

	PAGE
Left Naris with Hypertrophy of the Mucous Membrane (Zuckerkindl)	9
Right Nasal Chamber containing Two Large Polypi (Zuckerkindl)	9
Nasal Polypi with Slender Pedicles (Zuckerkindl)	10
Left Nasal Cavity with a Papilloma on the Inferior Turbinated Body (Zuckerkindl)	15
Transverse Section of Framework of Superior Maxilla, Anterior Segment. In the left antrum of Highmore is a large polypus (Zuckerkindl)	27
Outer Wall of Left Nostril (Seiler)	27
Synechia in Left Nasal Chamber (Zuckerkindl)	30
Transverse Section of the Framework of the Superior Maxilla, Anterior Segment showing Deviated Septum (Zuckerkindl)	37
Transverse Section through the Framework of the Superior Maxilla, Posterior Seg- ment showing Deformity	37
Contraction of the Maxillary Sinuses in Consequence of Excessive Outward Devia- tion of the External Nasal Walls (Zuckerkindl)	38
Sigmoid Deflection of the Septum, probably the Result of Fracture (Zuckerkindl) .	38
Oro-Pharynx and Soft Palate (Browne and Behnke)	192
Muscles of the Soft Palate and Pharynx (Gray and Browne)	193
Sectional View of the Pharynx (Lennox Browne)	195
Side View of Muscles of the Pharynx (Gray and Browne)	195
The Hyoid Bone, seen from above (Harrison Allen)	199
Front View of the Larynx: Thyroid Cartilage in Position (Lennox Browne) . . .	199
Side View of the Larynx (Lennox Browne)	199
Side View of the Larynx, showing the Interior, the Right Plate of the Thyroid Car- tilage being removed (Lennox Browne)	200
The Cricoid Cartilage, the Arytenoid Cartilages, and the Cartilages of Santorini (Cornicula Laryngis) (Harrison Allen)	201
The Hyoid Bone and Larynx, with Ligaments, seen from in Front (Harrison Allen).	201
The Same, seen from the Side (Harrison Allen)	201
Side View of the Larynx, showing the Left Ventricle of Morgagni, Left Epiglottic Ligament, etc. (Lennox Browne)	202
View of the Larynx opened from Behind (Lennox Browne)	203
The Rima Glottidis (Harrison Allen)	204
Side View of the Larynx, showing Right Crico-Thyroid Muscle (Lennox Browne) .	205
Muscles of the Larynx, seen from Behind (Lennox Browne)	205
Side View of the Larynx (Lennox Browne)	205
The Larynx opened from Behind (Harrison Allen)	206
The Larynx, displaying the Intrinsic Muscles, after the Removal of One Side of the Thyroid Cartilage (Harrison Allen)	206
Arterial Supply of the Larynx, Posterior View, showing the Distribution of the Superior Laryngeal Artery (Bosworth)	207
Arterial Supply of the Larynx, Anterior View, showing the Distribution of the In- ferior Laryngeal Artery (Bosworth)	207
The Larynx in Gentle Breathing (Lennox Browne)	209

	PAGE
The Larynx in Deep Breathing (Lennox Browne)	209
The Larynx in Tone-Production (Lennox Browne)	209
Lupus Vulgaris of the Palate and Fauces: Cicatrices, Disseminated Lupus Nodules, and Large and Small Tubercled Ridges, upon the Fauces, the Velum, and the Hard Palate (Chiari and Riehl)	418
Lupus Vulgaris of the Larynx: Tubercles and Ulcerations at the Base of the Tongue, and upon the Swollen, Crumpled Epiglottis: the Left Ventricular Band Thickened and Tubercled (Chiari and Riehl)	418
Large, Thick, and Congested Epiglottis, drawn backward by Lepro-Tubercled Masses: Enlarged Arytenoids	443
Tumefied Epiglottis hanging over Glottis; Enlarged and Congested Ary-Epiglottic Folds and Ventricular Bands, covered with large and small Leprous Tubercles	443
Leprous Tubercles on the Hard Palate and Velum (Leloir)	443
Enlarged and Thickened Epiglottis, with rounded edges curled inward, towards each other, the whole pale-grayish in color: on the upper margin were yellowish tubercles (Mackern)	443
Leprous Tubercles at Base of Tongue, on the Epiglottis, Left Vocal Cord, and Cartilages of Wrisberg (Wagner)	443
Leprous Distortion of Larynx (Lennox Browne)	443
Chronic Atrophic Laryngitis, showing Crusts adhering to Vocal Bands and Posterior Wall of Trachea (Ives)	475
Injury of Larynx from Contusion (J. H. Packard)	479
Scabbing-over of the Mucous Membrane after Application of Nitric Acid (Türk)	480
Gun-Shot Wound of Larynx, Left Side (Daly)	480
Catarrhal Ulceration of Vocal Cords (Türk)	481
More Extensive Ulceration, probably Catarrhal (Türk)	481
Piece of Boiled Beef in the Larynx (Poulet)	507
A Buckle in the Larynx (Pemberton)	507
Dime in the Larynx (Ives)	507
Lamella of Bone in the Larynx (Morell Mackenzie)	507
Brass Watch-Ring in the Larynx (Lefferts)	507
Piece of Glass in the Larynx (Ransom)	507
Tooth-Plate lodged in the Œsophagus (Silver)	544
Four figures showing the Early Forms of Syphilis of the Larynx. The conditions represented in these four figures date from the fourth, the sixth, and the eighth week after infection (J. Schnitzler)	818
Redness and Swelling of the Vocal Bands; the left vocal band shows on its edge a dark-red spot which was sharply defined by a grayish-white line (J. Schnitzler)	818
Three figures showing the Varied Forms of Syphilitic Papules on the Vocal Bands. These small, gray-white, mostly round or oval infiltrations are so characteristic that if once seen they are never forgotten (J. Schnitzler)	818
Appearance of the Larynx Several Months after Infection. Irregular Ulcers on the Vocal Bands: Characteristic Appearance of Syphilis of the Larynx. Two illustrations (J. Schnitzler)	818
Comparatively Circumscribed, but Deep, Syphilitic Ulceration on the Right Vocal Cord in Process of Healing (J. Schnitzler)	818
Complete Destruction of the Left Vocal Band, the Vocal Process alone intact. On the Left Ventricular Band Distinct Cicatrization. Cured after loss of entire left vocal band (J. Schnitzler)	818
Characteristic, Irregular Ulcers on the Edges of both Vocal Cords; in addition a Round, almost Typical Ulcer on the Left Arytenoid Cartilage (J. Schnitzler)	820
Irregular Ulcer on the Laryngeal Surface of the Epiglottis, Left Side, with beginning Ulceration on the Left Vocal Band and Left Arytenoid Cartilage (J. Schnitzler)	820
Ulcer on the Left Ventricular Band, with lardaceous, purulent covering (J. Schnitzler)	820
Intense Swelling of the Epiglottis: the latter is unrecognizable by reason of diffuse	

infiltration. Entrance to the cavity of the larynx entirely occluded. On the left half of the epiglottis, a deep, irregular ulcer with lardaceous covering: a second, crater-like ulcer on the outer surface of the right arytenoid cartilage extending to the ary-epiglottic fold (J. Schnitzler)	820
Advanced Syphilis of the Larynx. Characteristic ulcers following breaking down of gummous infiltration on the edges of the epiglottis and on the outer surface of the arytenoid cartilage. Dirty-gray, deep ulcers, with lardaceous covering and circumscribed by sharply-defined edges (J. Schnitzler)	820
The same Larynx after several weeks of Anti-Syphilitic Treatment. Cure of ulcers, with great loss of tissue. Characteristic cicatrices (J. Schnitzler)	820
Extensive and Profound Destruction of the Larynx, especially of the Epiglottis and Arytenoid Cartilage (J. Schnitzler)	820
Same Case, healed by Systematic Anti-Syphilitic Treatment (J. Schnitzler)	820

FIGURES.

Transverse Section of Erectile Turbinated Tissue, $\times 500$ (Seiler)	5
Section of the Cavernous or Erectile Tissue of the Middle and Lower Turbinated Bones, inflated and dried, $\times 2$ (Bigelow)	6
Section of Nasal Cavities, showing Nerve-Supply. Spheno-Palatine Ganglion, seen on its Internal Surface (Sappey)	8
Cleft Middle Turbinated Bone (Woakes)	10
Section of Mucous Polypus (Seiler)	11
Fibrous Polypus of the Nose—View of the Growth as seen by Posterior Rhinoscopy (Mackenzie)	12
Tubular Adenoma (Gross)	13
Section of Angioma, $\times 300$ (Seiler)	16
Syphilitic Ulcer of Nasal Mucous Membrane, slightly Diagrammatic, $\times 500$ (Seiler)	21
Dilated Nostril, showing Anterior Hypertrophy (Seiler)	26
Rhinoscopic Image from a Case of Posterior Hypertrophy of Middle Turbinated Bone (Seiler)	27
Rhinoscopic Image in a Case of Cleft Palate with Posterior Hypertrophy	27
Transverse Section of Nasal Hypertrophy (Seiler)	29
Dilated Nostrils, showing Eecondrosis of Septum	30
Posterior View of Congenital Bony Occlusion of Left Posterior Nares	31
A Split Septum (Seiler)	38
Pathological Specimen of Posterior Hypertrophy, showing Snare-Loop in Position (Jarvis)	44
Nasal Écraseur and Polypus Snare (Jarvis)	44
Removal of Posterior Turbinated Hypertrophies, with Rhinoscope and Tape-Holders in Position (Jarvis)	45
Transfixion-Needles (Jarvis)	45
Transfixion-Needle and Écraseur adjusted for Operation (Jarvis)	47
Operating Nasal Speculum (Jarvis)	50
Septometer (Jarvis)	50
Hæmostatic Clamp (Jarvis)	51
Small Septum Scissor-Punch (Jarvis)	52
Rongeur Septum Forceps (Jarvis)	52
C and C Electric Motor	53
Weber's Hand-Piece for Drills	54
Trephine Crown-Drill (Jarvis)	55
Antiseptic Crown-Drill (Jarvis)	55
Scissor Tubular Drill (Jarvis)	56
Deflection of Septum, before and after Operation (Jarvis)	56

	PAGE
Modified Steele's Stellate Septum-Punch (Jarvis)	57
Nasal Clamp-Splint	57
Monogenetic Nasal Myxoma associated with Deflection of the Septum (Jarvis) . . .	60
Small Spring Scissor-Punch	60
Écraseur Tips for Adenoids	61
Cavernous Angioma (Jarvis)	62
Sarcoma of Nose and Superior Maxilla (J. Bryant and Jarvis)	63
Syphilitic Caries of the Nose and Mouth (Jarvis)	64
Congenital Nasal Atresia, before Operation (Jarvis)	65
“ “ “ after “ “	65
Vocal Cords in Phonative Position	220
Diagram showing Action of Crico-Thyroid Muscle, Stretching of the Vocal Cords, and Altered Direction of Sound	222
Muscles and Cartilages concerned in Phonation	223
Three Diagrams representing Position of Vocal Cords in Different Registers (Behnke)	224
Nineteen Photographic Views of Laryngeal Images corresponding to Different Notes of the Musical Scale (French)	228, 229, 231, 232, 233
Diagram of Phonetic Arch formed by the Tongue and Soft Palate in Singing . . .	235
Four Diagrams showing Variations of the Phonetic Arch in the Singing of Different Notes (Browne and Behnke)	236
Diagrammatic Representation of a Musical Note in its Extent from the Larynx to the Lips	237
Six Diagrams representing the Varying Capacity of the Chest according to the Method of Inflation (Lennox Browne)	238
Inflammation confined to Epiglottitis and Right Ventricular Band (Lennox Browne) .	312
Œdema of Epiglottitis, “Acute Miasmatic Epiglottitis” (Arnold)	313
“Rugæ” of Inner Arytenoid Space simulating Ulceration in Simple Laryngeal Catarrh	316
General Œdema Laryngis from Burn	318
Subglottic Œdema (Cohen)	318
Lupoid Ulceration of Epiglottitis, and Subglottic Œdema	319
Paresis of the Vocal Cords	320
Introducing-Instrument and Obturators	390
Gauge for Tubes at any Given Age	391
Gag used in Intubation	392
Extracting-Instrument	392
Golding-Bird's Tracheal Dilator	398
Trousseau's Tracheal Dilator	398
Fenestrated Obturator	399
Tracheal Forceps used in Tracheotomy	400
Plug with Shield to keep Tracheotomy-Wound from Healing (Parker)	408
Chronic Laryngeal Catarrh, showing a Nodule on the Right Vocal Band from Ex- traordinary Hyperplasia at that Point (Burow)	470
Chronic Inflammation of the Vocal Bands, with Subglottic Swelling (Türk) . . .	470
Chronic Laryngeal Catarrh, showing Particular Swelling and Injection of the Left Vocal Band (Burow)	471
Chronic Laryngeal Catarrh, showing Swelling of Ventricular Bands (Burow) . . .	471
Chronic Laryngeal Catarrh, showing Secretion adhering to the Vocal Bands and at the Inter-Arytenoid Space (Burow)	471
Chronic Laryngeal Catarrh, with Aphonía from Interstitial Deposit (Burow)	471
Œdematous Laryngitis, showing the whole Mucous Membrane swollen, and particu- larly the Arytenoids and Posterior Wall of the Larynx (Burow)	472
Œdematous Laryngitis, showing a more Chronic and Partial Involvement (Burow) .	472
Œdematous Laryngitis, showing Swelling mostly confined to the Epiglottis (Burow). .	472
Œdema and Hypertrophy of the Ventricular Bands after Typhus Fever (Türk) . . .	472

	PAGE
Perichondritis Laryngis affecting principally the Left Arytenoid Cartilage (Burow)	473
Pachydermia Laryngis (Bergengrün)	473
Chorditis Vocalis Hypertrophica Inferior (Burow)	474
Chorditis Vocalis Hypertrophica Inferior, showing Great Diminution in Size of the Vocal Bands (Burow)	474
Laryngitis Hæmorrhagica (Burow)	474
Perichondritis of the Left Vocal Cord: Unopened Abscess (Türk)	482
The Same, after Opening of the Abscess (Türk)	482
Perichondritis Laryngis (Burow)	482
Laryngeal Appearance of Enchondroma (Türk)	482
Chorditis Vocalis Hypertrophica Inferior following Typhus Fever, showing Membranous Growth on Under Surface of the Vocal Bands (Burow)	485
Membranous Stenosis of the Larynx the Result of Typhoid Fever (Burow)	486
Membranous Stenosis of the Larynx, showing Effects of Treatment—Incision and Dilatation (Burow)	486
Shurly's Face-Shield Inhaler	489
Tin Inhaler	490
Dry Inhaler	490
Shurly's Powder-Blower	491
Puff-Darts, American Pattern (Wyeth): English Pattern lying in the Bronchus (Bruce)	504
Toy Locomotive in the Larynx (Johnston)	505
Piece of Bone lodged in the Larynx (F. W. Rockwell)	508
Bead in the Right Bronchus: two positions (Sprengel)	509
Bronchial Septum (S. D. Gross)	509
Cusco's Forceps	523
Mackenzie's Angular Forceps	523
Mackenzie's Tube Forceps	524
A Coin in the Laryngeal Ventricle (Grazzi)	524
The Same, in the Grasp of the Instrument (Grazzi)	524
Piece of Bone in the Larynx: two positions (Whistler)	525
A Cockle-Burr in the Larynx (Thorner)	525
Trousseau's Tracheal Dilator	529
Laborde's Dilator	530
Golding-Bird's Double Retractor	530
Gross's Tracheal Forceps	530
Cohen's Shouldered Traction Forceps	530
Roe's Tracheal Forceps	531
Large Open Pocket-Knife removed from the Œsophagus by Œsophagotomy, Natural Size (Gussenbauer)	536
Specimens of Irregular Fragments of Bone lodged in the Œsophagus, Natural Size (Poulet)	537
Tooth-Plate impacted in the Œsophagus during an Epileptic Seizure (MacCormac)	539
Tooth-Plate (MacLean)	544
Pin perforating the Œsophageal Ganglion (Dagron)	547
Perforation of the Œsophagus and Trachea by Piece of Bone (Poulet)	547
Perforation of the Œsophagus and Aorta by a Five-Franc Piece (Poulet and Denonvilliers)	548
Duplay's Resonator	553
Mackenzie's Œsophagoscope: <i>a</i> , closed for insertion; <i>b</i> , opened after introduction	553
Fauvel's Forceps, Antero-Posterior View	558
Fauvel's Forceps, Lateral View	558
Moe's Gum-Elastic Forceps	559
Dawson's Flexible Forceps	559
Mathieu's Alligator Forceps	559
Bond's Forceps (modified by Roe)	559

	PAGE
Petit's Hook	560
Graefe's Basket, Natural Size	560
Graefe's Ring Coin-Catcher	560
Roe's Flexible Spiral Lever Extractor: two positions	560
Gross's Bristle Probang: two positions	561
Sanford's Probang	561
Roe's Dilating Extractor: two positions	561
Bosworth's Tonsil Snare	583
Wright's Electric Amygdalotome	584
Electric Tonsil Snare (C. H. Knight)	584
Clendinnen's Tonsil-Compressor	590
Mackenzie's Tonsillotome	592
Bilateral Paralysis of Superior Laryngeal Nerve (Porcher)	685
Bilateral Recurrent Laryngeal Paralysis (Porcher)	686
Right Recurrent Laryngeal Paralysis: Position of Cords in Deep Inspiration (Porcher)	687
Bilateral Abductor Paralysis: Position of Cords in Deep Inspiration (Porcher)	689
Unilateral Adductor Paralysis: Position of Cords in Attempted Phonation (Porcher)	692
Paralysis of the Arytenoideus Muscle (Porcher)	692
Paralysis of Right Internal Tensor (Porcher)	693
Delavan's Alimentation-Bottle	707
Mackenzie's Œsophageal Injector	708
Congenital Stenosis of the Pharynx (Lennox Browne)	711
Syphilitic Outgrowth from the Pharynx (Lennox Browne)	718
Congenital Pouch and Atresia of the Pharynx (Lennox Browne)	718
Pouch of the Pharynx in Advanced Life (Lennox Browne)	719
Microscopic Section of Lymphoma (Lennox Browne)	720
Papilloma of the Pharynx (Lennox Browne)	724
Section of Papilloma of Pharynx (Lennox Browne)	725
Spindle-Cell Sarcoma of the Pharynx (Lennox Browne)	729
Lympho-Sarcoma of Pharynx (Lennox Browne)	730
Lympho-Sarcoma of Pharynx and Œsophagus (Lennox Browne)	730
Alveolar Epithelioma of the Pharynx: Microscopic Section (Lennox Browne)	732
Prickle-Cell Epithelioma: Microscopic Section (Lennox Browne)	733
Congenital Web of the Pharynx: two figures (Morell Mackenzie)	736
Congenital Papilloma of Larynx (Lennox Browne)	739
Recurrent Papillomata of Larynx of Congenital Origin (Lennox Browne)	739
Two Illustrations of Syphilitic Stenosis (Lennox Browne)	745
Cicatricial Stenosis before and after Treatment (Lennox Browne)	746
Hollow Laryngeal Dilator, with Cutting Blade (Lennox Browne)	747
Supra-Glottic Stenosis of Larynx due to Lupus (Lennox Browne)	748
Papillomata of the Larynx (Lennox Browne)	752
Single Papilloma of the Larynx with Syphilitic History (Lennox Browne)	753
Symmetrical Papillomata with Syphilitic History (Lennox Browne)	753
Papilloma of Vocal Cord in the Common Situation (Lennox Browne)	754
Histological Features of a Papilloma (Lennox Browne)	755
Fibroma situated on Under Surface of Right Vocal Cord (Lennox Browne)	756
Fibroma of Left Vocal Cord (Lennox Browne)	757
Myxoma of Right Vocal Cord: two figures (Lennox Browne)	758
Fibro-Myxoma of Larynx (Lennox Browne)	758
Mucous Growths of Larynx accompanying Papillomata (Lennox Browne)	758
Adenoma of the Larynx: three figures (Lennox Browne)	759
Thrombosed Angioma of the Larynx, showing Complete Section and Detail of Structure: two figures (Lennox Browne)	761
Gibbs's Laryngeal Snare	763
Voltolini's Laryngeal Sponge-Probang	763

	PAGE
Dundas Grant's Guarded Forceps	765
Three Illustrations of Cancer of the Larynx by Contiguity with the Pharynx (Lennox Browne)	774
Laryngoscopic Appearance of a Sarcoma (Lennox Browne)	779
Post-Mortem Appearance of the Same (Lennox Browne)	779
Sarcoma of the Tonsil (Lennox Browne)	780
Sarcoma of the Epiglottis and Larynx in the Same Case (Lennox Browne)	780
Sarcoma of the Larynx (Lennox Browne)	781
Epithelioma, Laryngoscopic View (Lennox Browne)	788
Epithelioma of Larynx, Left Wing of Thyroid, Left Half of Cricoid, and Left Arytenoid Cartilage, showing Extensive Area of New Growth (Lennox Browne)	790
Thickened Omega-Like and Ulcerated Epiglottis (J. Solis Cohen)	793
Progressive Ulceration of Epiglottis (J. Solis Cohen)	793
Destructive Ulceration of Epiglottis (J. Solis Cohen)	793
Initial Multiple Superficial Ulcerations of the Acuter Forms of Secondary Tuber- culosis (J. Solis Cohen)	796
Supra-Arytenoid Intumescence, beginning on the Left Side and Complete on the Right (J. Solis Cohen)	799
A Later Stage of Supra-Arytenoid Intumescence, with Thickenings in the Epiglottis and on the Vocal Bands (J. Solis Cohen)	799
Turban-Like Epiglottis of Tuberculosis (J. Solis Cohen)	800
Crescentically Swollen Epiglottis overhanging the Orifice of the Larynx (J. Solis Cohen)	800
Tuberculous Infiltration of Larynx, showing Lateral Destruction of Epiglottis from the Side (J. Solis Cohen)	800
Condylomatous Meso-Arytenoid Infiltration; Color Normal; Softening at Right Apex (J. Solis Cohen)	801
Acuminated Meso-Arytenoid Infiltration; Red Right Vocal Band; Condensation at Right Apex (J. Solis Cohen)	801
Ulcerated Vocal Bands and Left Ventricular Band; Solidification at Right Apex; Cavity in Left Apex (J. Solis Cohen)	801
Abscess over Right Side of Internal Face of Cricoid Cartilage (J. Solis Cohen)	802
Club-Shaped Uvula in Primary Tuberculosis of the Larynx. Palate involved (J. Solis Cohen)	805
Hypertrophic Glands simulating Tubercles (J. Solis Cohen)	806
Schroetter's Laryngeal Dilator	825

AUTHORS REFERRED TO IN VOLUME II.

- Abbe, 512, 542, 544, 564, 567.
 Abercrombie, 329.
 Abraham, 440, 441, 726.
 Abramson, 113, 135.
 Abulcasis, 3.
 Abutkoff, 537.
 Adams, 49, 537.
 Addenbrook, 528.
 Adelman, 555, 563, 566.
 Ægina, Paul of, 2.
 Aetius, 2.
 Agnew, D. H., 505, 616.
 Aitken, 336, 642, 663.
 Albert, 58.
 Alderson, 599.
 Alexander, 538, 569.
 Alibert, 414.
 Allbutt, Clifford, 522, 554.
 Allen, Harrison, 37, 48, 131, 155,
 158, 165, 273, 463, 534, 574,
 595, 596, 611.
 Althaus, 93.
 Alvaro, Mendez, 436, 439.
 Anderson, 545.
 Andral, 116.
 Andrews, 549.
 Andriessen, 510.
 Annandale, 529.
 Anstie, 132, 141.
 Antonies, 537.
 Antonoff, 546.
 Appleyard, 502.
 Arantius, 3.
 Archambault, 411, 666.
 Aretæus, 102.
 Aristotle, 102.
 Arning, 413.
 Arnold, 521.
 Arnot, 551.
 Arnoz, 139.
 Aronssohn, 92, 146, 504, 506,
 514, 531.
 Arviset, L., 99.
 Asch, 49, 493, 604, 664, 749, 761.
 Aschenbrandt, 98.
 Asclepiades, 396, 526.
 Ashhurst, John, 501, 504, 506,
 516, 521, 535, 552, 553, 556,
 565.
 Atkinson, 610.
 Atlee, 546.
 Aubrun, Sr., 380.
 Audebert, 478.
 Augagneur, 129, 159.
 Auspitz, 414.
 Avery, 519.
 Avicenna, 102.
 Baber, Cresswell, 110, 598, 617,
 723.
 Babès, 343, 443, 446, 448, 451,
 453.
 Bach, 213.
 Baginsky, 346, 347, 360.
 Baker, H. B., 363.
 Balch, 535, 557.
 Bally, 545.
 Balme, 575, 576.
 Balujew, 535, 546, 567.
 Bannister, 505.
 Baptie, 158.
 Baraffio, 538, 556.
 Baratoux, 105, 114, 412, 421,
 565.
 Baring, G., 480.
 Barker, 619.
 Barré, 593.
 Barth, B., 465.
 Barthez, 348, 396.
 Bartholini, 102.
 Bartholow, 255, 622, 633, 634,
 654, 655.
 Bartlett, 520.
 Barton, Isaac, 461, 567.
 Baruch, 650.
 Bates, 170, 356.
 Battle, 535.
 Baud, 539, 563.
 Baudens, 575.
 Bauduy, J. K., Jr., 372.
 Baumgarten, 91, 343, 422, 607.
 Baxter, 154.
 Bayer, 597.
 Bazin, 414, 439, 542.
 Bean, 115, 475, 605, 610.
 Beard, Geo. M., 67, 68, 70, 73,
 78, 79, 80, 83, 131.
 Beclard, 92.
 Bednar, 349.
 Beebe, 611.
 Beeston, 529.
 Begbie, 660.
 Bégin, 537, 567.
 Behnke, 216, 218, 219, 224, 226,
 227, 235, 239, 240.
 Behrend, 501.
 Belde, 654.
 Bell, 503, 527, 547, 743.
 Bender, Max, 413.
 Béneque, 565.
 Bennett, 644.
 Benno, 657.
 Benoit, 504.
 Benthall, 502.
 Bentlif, 515, 528.
 Berard, 507.
 Bereskin, 587.
 Bergengrün, 469, 473, 478.
 Berger, 130, 150, 152, 153, 154,
 155, 156, 157, 164, 169.
 Bergeron, 459.
 Bergmann, 416, 427, 430, 494,
 529.
 Bergonié, 49.
 Bergson, 115.
 Bernabei, 251.
 Bernard, Claude, 90, 98, 697.
 Bernardino, 582.
 Bernardo, 653.
 Bernutz, 635.
 Besnier, 186, 415, 421, 422.
 Bettman, 129, 130, 169.
 Beverley, 527.
 Bianchi, L., 341.
 Bierbaum, 662.
 Bierfreund, 537.
 Biermer, 115.
 Bigelow, 6, 99, 349.
 Bild, 354.
 Bilhaut, 355.
 Billington, 381, 623.
 Billroth, 556, 586, 644, 785.
 Bimar, 722.
 Binnerger, 66.
 Binz, 67, 87.
 Biondi, 318.
 Birch, 521.
 Birch-Hirschfeld, 311.
 Bird, 620.
 Bischoff, 697.
 Bishop, 535, 697.
 Black, 428.
 Blackader, 637.
 Blackley, 67, 68, 69, 70, 72, 76,
 83, 87.
 Blair, 576, 594.
 Bianco, 508, 526, 770.
 Blandin, 48, 49, 618.
 Blandon, 526.
 Blass, 647.
 Bloch, 140.
 Block, 117, 415.
 Blount-Dyer, 323.
 Blum, 502, 516.
 Bobbitt, 535, 557.
 Bobone, 108.
 Boch, 660.
 Boeck, 436, 439.
 Boecker, 106.
 Boerhaave, 3.
 Bohn, 638.
 Bolton, 49.
 Bond, 558, 559.
 Bonet, 519, 545.
 Bonheben, 19.
 Bonito, 598.
 Borelli, 582.
 Bostock, John, 66, 67.
 Bosworth, 4, 8, 9, 15, 22, 23, 24,
 25, 32, 33, 34, 35, 37, 41, 43,
 46, 48, 59, 61, 62, 63, 94, 95,
 105, 109, 113, 117, 119, 121,
 123, 134, 135, 194, 253, 255,
 257, 260, 261, 263, 308, 323,

- 458, 491, 513, 573, 583, 609,
670, 684, 688, 690, 772.
- Botalius, 66.
- Bottini, 611, 781, 785.
- Bouchard, 664.
- Boucheron, 462.
- Bouchut, 349, 390.
- Bouillon-Lagrange, 348.
- Boulard, 533.
- Bouloché, 251.
- Bourdillat, 518, 519.
- Bourges, 346, 628.
- Boyer, 2, 32, 33.
- Brandeis, 486, 525.
- Braun, 480.
- Brebion, 114.
- Breda, 427.
- Bresgen, M., 129, 136, 139, 152,
159, 163, 164.
- Bretonneau, 349, 371.
- Briand, 662.
- Bricheteau, 378.
- Briddon, 502, 523.
- Brieger, 344, 345, 484.
- Brissard, 467.
- Broca, 555, 589.
- Brodie, 521.
- Bron, 32.
- Brooks, 89.
- Broussais, 506, 510, 513.
- Brown, Bedford, 649.
- Brown, C. Haig, 275.
- Brown, Graham, 387.
- Brown-Séguar, 119, 487.
- Browne, Lennox, 4, 49, 61, 93,
114, 129, 130, 170, 216, 235,
240, 253, 262, 274, 275, 311,
312, 315, 318, 332, 333, 337,
340, 412, 413, 417, 426, 431,
452, 459, 460, 467, 475, 479,
485, 489, 503, 576, 606, 607,
609, 613, 614, 615, 670, 673,
679, 680, 683, 778.
- Brownell, 514.
- Bruce, 502, 504, 513.
- Brugelmann, 136.
- Brunel, 528.
- Bruns, 721, 746, 761, 770, 791.
- Bryan, J. H., 254.
- Bryant, W. S., 16, 63, 505, 515.
- Buchanan, 660.
- Buck, A. H., 137, 140.
- Buck, Gurdon, 660.
- Buckholtz, 387.
- Bucklin, 159, 160.
- Bull, 157, 538.
- Bullock, 508, 510.
- Bumstead, 600.
- Burekhardt, 15.
- Burger, H., 339, 340.
- Burnett, C. H., 41, 101, 128.
- Burns, Allan, 515.
- Burow, 470, 471, 472, 473, 474,
482, 485, 486, 502.
- Busch, 546, 549.
- Busey, 623, 626.
- Bushe, 528.
- Bussard, 546.
- Butler, 590.
- Butlin, 512, 526, 527, 567, 613,
619, 620, 621, 770, 773, 791.
- Buttenberg, 546.
- Cadier, 135.
- Cadogan-Masterman, 375.
- Caesar, 501.
- Cagny, 356.
- Cahier, 568.
- Caillé, 366, 377.
- Campana, 440, 452.
- Campbell, 415, 607, 711.
- Cant, 59, 566.
- Capart, 61, 256, 458, 587.
- Cardone, F., 269.
- Carion, Stellwag von, 165.
- Carlyle, 534, 538, 539.
- Carstens, J. H., 464.
- Cartay, 106, 108, 111, 135, 664.
- Cartier, M., 480.
- Casabianca, 17, 19.
- Castle, 547.
- Caswell, 528.
- Catti, 562.
- Cazenave, 86, 87, 89.
- Celsus, 2, 582.
- Cerchez, 508.
- Cerlot, 650.
- Cerutti, 93.
- Championnière, 140.
- Chantemesse, 628.
- Chapman, S. H., 466.
- Chappell, 502, 503, 579.
- Charcot, 94, 120, 341.
- Chassaignac, 575, 593, 662.
- Chauliac, Guy de, 3.
- Cheadle, 642, 666.
- Cheatham, 41, 89, 129, 159, 170.
- Cheever, 545, 554, 569, 616, 618,
619.
- Cheselden, 589.
- Chessman, 510, 513.
- Cheyne, 329.
- Chiari, 262, 412, 413, 417, 426,
469, 478, 652, 747.
- Chiolini, 611.
- Chomel, 655.
- Christian, 503.
- Christina, 511.
- Chrystie, 663.
- Clark, Andrew, 87, 116, 165, 170,
512, 531, 545.
- Clarke, E. W., 590.
- Claubry, Gauthier de, 542.
- Clendinnen, 590.
- Cline, 171.
- Cloquet, 96.
- Clutton, 552, 567.
- Coats, 548.
- Coester, 384.
- Cohen, J. Solis, 4, 11, 42, 49, 61,
108, 113, 141, 260, 270, 271,
274, 277, 282, 287, 312, 318,
322, 332, 337, 408, 458, 459,
460, 462, 463, 464, 467, 475,
480, 482, 483, 487, 489, 491,
492, 493, 494, 495, 504, 505,
506, 516, 521, 523, 541, 542,
544, 547, 551, 553, 565, 574,
579, 580, 597, 612, 618, 623,
635, 636, 639, 640, 643, 644,
646, 648, 649, 651, 654, 657,
663, 664, 665, 669, 683, 770,
785, 786.
- Cohen, S. Solis, 493.
- Cohnheim, 306, 311, 317, 415.
- Coit, 579.
- Coleman, S. C., 356, 357.
- Colles, 4, 548, 550.
- Collier, 504, 529.
- Collin, 549.
- Collins, F. H., 553, 647.
- Conner, 502, 528.
- Coomes, 461, 519.
- Cordemans, 568.
- Coriveaud, 134.
- Cornil, 414, 422, 439, 443, 602,
643.
- Couetoux, 129, 130.
- Coupard, 666.
- Coupland, 507.
- Courtenay, 542.
- Coyne, 639.
- Cozzolino, 138.
- Craigie, T. F., 631.
- Crawley, 523, 525.
- Créquy, 563, 564.
- Croker, G., 723.
- Croly, 614.
- Crooke, 279.
- Crossfield, 135.
- Cruveilhier, 99, 652, 712, 722.
- Cullen, 96.
- Curschmann, 634.
- Curtis, 49, 55.
- Cusco, 523, 524.
- Cuvillier, 582.
- Czermak, 429.
- Czerny, 618.
- Da Costa, 514.
- D'Agnano, 95.
- Dagron, 547.
- Dailey, 520.
- Daly, 41, 43, 67, 68, 70, 103, 139,
140, 141, 270, 384, 465, 480.
- Dana, C. L., 94.
- Danaher, 502, 511, 514, 516.
- Danielssen, 436, 439.
- Dantra, 537.
- D'Arey, 510.
- Darwin, 212.
- Davaine, 600.
- Davidson, 510.
- Davies, 566.
- Davy, 531.
- Dawson, 502, 510, 558, 559.
- Day, 522.
- Deacon, 239.
- De Angelis, 513.
- Dearden, 560.
- Deaver, 564, 568.
- De Blois, 42, 579, 610.
- Debout, 510.
- De Budberg, 87.
- De Cassis, Vidal, 501, 506.
- Dechambre, 84.
- Decker, 598.
- De la Count, 508, 510, 513.
- Delafield, 475.
- De la Hale, Adam, 213.
- Delasiauve, 502, 514.
- De la Sota y Lastra, 502, 525,
535, 568, 608.
- Delavan, 16, 50, 59, 139, 194,
195, 461, 465, 481, 494, 576,
580, 588, 591, 604, 605, 606,
611, 643, 645, 647, 651, 709.
- Delewsky, 386.
- Délie, 599.
- De Marigual, E., 348.
- Demarquay, 563.
- De Mees, 540.
- Demme, 24, 415.
- Denton, 556.
- De Rechter, 109.
- Desbrousses, 666.
- Deschamps, 102.
- De Schweinitz, 163, 164, 166.
- Desgranges, 519.
- Desiré, 532, 812.
- Despagnet, 129, 159, 160, 164.
- D'Espine, 348, 374.
- Dessault, 539.

- Desvernine, 568, 742.
 Devergie, 414.
 Dieffenbach, 48.
 Dmochowski, 571, 605.
 Donaldson, 58, 477, 580, 601, 618.
 Donatus, 510.
 Dorr, 515.
 Doutrelepont, 414.
 Dove, 538.
 Dowling, 159.
 Downie, J. W., 586, 590.
 Dowse, 502.
 Dress, 135, 137, 140.
 Druitt, 591.
 Du Bois-Reymond, 224.
 Duchamp, 351.
 Duchenne, 701.
 Duclos, 116.
 Ducros, 115.
 Dufour, 742.
 Duhring, 428.
 Dumas, 387.
 Dumenil, 15.
 Dumez, 363.
 Duncan, 521, 742.
 Dunglison, 2.
 Dunn, J., 129, 130, 153, 160, 591.
 Duplay, 19, 553.
 Dupuy, 555.
 Dupuytren, 510, 565, 577, 578, 600, 734.
 Duret, 219.
 Durham, 4, 17, 401, 406, 517, 518, 520, 528, 532, 570.
 D'Urto, 526.
 Duval, 534.
 Dzondi, 4.
 Eales, 170.
 Edis, 759.
 Edwards, 502, 507, 641, 642.
 Egeberg, 568.
 Ehrlich, 416, 423, 427, 431, 448.
 Eichhorst, 268.
 Ekel, 515.
 Eldridge, 510.
 Elias, 501.
 Eliot, Llewellyn, 385, 726.
 Elliottson, 87, 154, 512, 516.
 Elsberg, 104, 114, 134, 135, 139, 341, 466, 470, 483, 494, 554, 745.
 Emminghaus, 642.
 Emrys-Jones, A., 154.
 Ensing, 110.
 Epler, 513.
 Eppinger, 310, 311.
 Erichsen, 16, 58, 59, 548.
 Esch, J. P., 373.
 Esmarch, 430.
 Espey, J. R., 377.
 Esquirol, 536.
 Eulenburg, 669.
 Evans, 556.
 Eve, 485, 546, 549.
 Fabricius ab Aquapendente, 3, 526.
 Fabry, 21.
 Fagge, Hilton, 331, 622, 623, 625, 636, 644, 654, 655, 656, 666, 668.
 Farlow, 591, 723.
 Farmer, 582.
 Farr, 330.
 Fauvel, 135, 426, 466, 519, 558, 666, 752, 764, 771, 772, 784.
 Fayrer, 19.
 Fehleisen, 268, 269, 644, 648.
 Félizet, 568.
 Fell, 521.
 Fenykövy, 109, 139.
 Ferber, 102, 131.
 Féré, 108.
 Ferguson, 373, 380.
 Fernellus, 102.
 Ferrein, 219.
 Ferrier, 219.
 Ferrus, 540, 555.
 Festier, 712.
 Ficano, 501.
 Fick, 250.
 Fienzal, 162.
 Figueira, 532.
 Filipo, 440.
 Fincke, 135.
 Fingerhuth, 547.
 Fischer, 159, 318, 466, 567, 568, 569.
 Fitz, 549, 521.
 Fitzgerald, 611.
 Flatau, 136.
 Fleck, 387.
 Fleisher, 658.
 Flemming, 279.
 Flesh, 336.
 Fleury, 549, 550.
 Flint, 622, 631, 640, 644, 650, 651, 653, 660, 663.
 Fogg, 513.
 Follin, 18.
 Forchheimer, 271, 662.
 Fortuner, 545.
 Foster, 120, 528.
 Foulis, 786.
 Fountaine, 373.
 Fournier, 601.
 Fowler, George B., 384, 617.
 Fox, Colcot, 713.
 Fox, George H., 415, 421, 452.
 Fox, Kingston, 275.
 Fox, R. Hingston, 136.
 Fracl, 416.
 Fraenkel, B., 105, 115, 116, 134, 138, 263, 316, 346, 416, 427, 462, 483, 507, 598, 652, 664, 773, 783, 793.
 Fraenkel, C., 344, 345.
 Fraenkel, E., 99, 103, 104, 113, 135, 597.
 Franco of Cologne, 213.
 Francotte, 356.
 Frank, François, 139.
 Franke, F., 111.
 Frankhauser, 507.
 Franks, 546, 566, 612.
 Freeland, 536, 568.
 Freeman, 501.
 French, 226, 227, 234, 491, 512, 525.
 Frew, 541, 542, 568.
 Friedländer, 414, 423.
 Fritsche, 484.
 Froriep, 506.
 Fruitnight, 387.
 Fuller, 591.
 Fulton, 167.
 Furner, 568.
 Fürst, 506.
 Gairdner, 598.
 Galen, 2, 102, 526.
 Galentine, C. B., 387.
 Gallardo, 617.
 Gamberini, 439, 440.
 Gant, 531.
 Garcia, 225.
 Garel, 465, 595.
 Gariel, 565.
 Garre, 412.
 Garrett, 218.
 Gassicourt, Cadet de, 374.
 Gaupp, 501.
 Gautier, 501, 508, 565, 597, 599.
 Gay, 403, 552, 568.
 Gee, 623.
 Gelsner, 386.
 Gennaro, 135, 137.
 Geoghegan, 502, 527.
 Gerasimow, 389.
 Gerdy, 9.
 Gerhardt, 269, 320, 356, 466, 484, 639.
 Germain, 552.
 Germonig, 650, 651.
 Gerster, 506, 551, 556.
 Gibb, 318, 446, 523, 635, 636, 648.
 Gibbes, 483, 485.
 Gibbs, 758, 760, 763.
 Gill, 336.
 Giommi, 568.
 Glandorf, 3.
 Glasgow, 131, 486, 503, 509, 650, 651, 759, 809.
 Gleitsmann, 316, 584, 586.
 Godet, 501.
 Goetze, 131.
 Golding-Bird, 398.
 Gooch, 357.
 Goodall, 508.
 Goodhardt, 623, 632, 638, 641.
 Goodwillie, 48, 49, 55.
 Gordon, 67, 85, 128, 160.
 Gordone, 648.
 Gorecki, 619.
 Gottschalk, 91.
 Gottstein, 106, 328, 332, 339, 423, 446, 463, 470, 477, 484, 485, 608, 683, 747.
 Gouguenheim, 256, 465, 478, 539, 751, 802.
 Gourerwitsch, 96.
 Gradie, 61, 128, 150.
 Graefe, 539, 540, 560, 563.
 Grancher, 363, 364, 367, 368, 375.
 Grant, Bey, 382.
 Grant, Dundas, 93, 333, 741, 753, 764, 765, 771, 784.
 Graves, R. J., 92, 110, 344.
 Gray, 341, 614.
 Grazi, 95, 512, 524.
 Green, J. T., 488.
 Green, T. Henry, 475, 479, 485, 511, 512, 516.
 Gridley, 520.
 Griesinger, 655, 660.
 Griffith, 642.
 Groom, 511, 528.
 Gross, M., 459.
 Gross, S. D., 58, 478, 500, 503, 505, 508, 509, 510, 511, 513, 514, 517, 518, 519, 520, 521, 528, 561, 568, 649.
 Grossmann, 413.
 Grove, 239.
 Grubert, 568.
 Grüber, 656.
 Grün, 510, 511.
 Grünfeldt, 19.
 Gruening, 41, 129, 164, 168, 599.
 Grünwald, 156.
 Gruhn, 165.

- Gruner, 4, 102.
 Grut, 165.
 Grynfeltt, 595.
 Gubler, 268.
 Guelton, 543.
 Guersant, 348, 396, 592.
 Guest, 508, 516.
 Guido of Arezzo, 213.
 Guillemeau, 586.
 Guinaud, 602.
 Gussenbauer, 536, 568.
 Guttman, 265, 311, 346, 386, 651.
 Guye, 136.
 Guyon, 15, 501, 723.
 Habel, 556.
 Habgood, 530.
 Hack, 41, 75, 103, 104, 106, 108, 110, 114, 128, 130, 131, 135, 136, 137, 150, 156.
 Hadden, 502.
 Haenisch, 115, 661.
 Hagedorn, 521.
 Hager, 514, 650.
 Hahn, 416, 427, 430, 431, 787, 788, 790.
 Haidenhain, 415.
 Hajek, 155.
 Hallepeau, 374.
 Haller, 93.
 Halstead, 539, 552, 568.
 Hamburger, 554.
 Hamilton, 93, 129, 130, 160, 169, 505.
 Hammond, 141.
 Hanford, 521.
 Hanot, 650, 652.
 Hansen, Armaner, 439, 440, 448.
 Hardaway, 638, 640, 641.
 Hardy, 414, 415, 440.
 Harrison, 514.
 Hartman, J., 474, 494.
 Hartmann, 103, 131, 156, 316.
 Haslund, 413.
 Hauff, 668.
 Havenith, 415.
 Hays, 541.
 Heath, 527, 539, 540, 645.
 Hebra, 185, 414, 608.
 Heim, 641.
 Heine, 746, 785.
 Heinze, 794, 795.
 Heister, 3.
 Helbing, 263.
 Helfferich, 387.
 Helmholtz, 67, 72, 87, 216, 545.
 Hemenway, 596, 597, 598.
 Henderson, 42.
 Hendrig, 159, 162.
 Henoeh, 340, 346, 372, 375, 388, 638.
 Henry, F. P., 810.
 Hérard, 110.
 Hermann, 507.
 Hernandez, 387, 590.
 Hernando, 436, 437, 439, 446.
 Hertz, 505, 662.
 Heryng, 105, 111, 114, 135, 300, 429, 495, 534, 566, 574, 587, 595, 597, 745, 746, 811.
 Herzfeld, 99.
 Herzog, 73, 164, 466.
 Hess, 509.
 Heurteaux, 17.
 Heusser, 502, 506, 516.
 Hévin, 519, 533, 537, 545, 557, 570.
 Hewitt, 400.
 Heymann, 106.
 Hill, William, 136.
 Hillis, 443, 446.
 Hilton, 4, 59, 501.
 Hime, F. W., 427.
 Hinkel, 89, 110.
 Hinrichs, 525.
 Hippocrates, 2, 21, 58, 102.
 Hoang-Ty, 21.
 Hodenpyl, 572.
 Hodgkinson, 512.
 Höhle, 711.
 Hoffmann, 122, 129, 567, 655.
 Holden, 221, 223, 507, 527, 670, 694.
 Holm, 413.
 Holmes, 494, 517, 518, 528, 563, 570, 580.
 Holt, 389, 722.
 Homans, 616.
 Home, Everard, 329, 711.
 Honman, A., 653.
 Hooper, 61.
 Hooper, 221, 465, 470.
 Hopmann, 14, 15, 19, 105, 138.
 Hopper, 479.
 Hopton, 527.
 Horsley, 219.
 Houston, 505, 506.
 Houtang, 717.
 Howard, 218.
 Hows, 531.
 Howse, 506.
 Hubert, 50.
 Huchald, 213.
 Hue, 601.
 Hürlin, 624.
 Huguer, 15.
 Hulke, 512.
 Hullah, 243.
 Hunt, James, 212.
 Hunt, Middlemas, 413, 414.
 Hutchinson, James H., 654, 660.
 Hutchinson, Jonathan, 414, 415, 416, 420, 421, 422, 426, 738, 780.
 Hutinal, 628.
 Huxley, 221.
 Hyde, J. N., 634, 636.
 Ingals, 48, 129, 272, 318, 466, 487, 513, 583, 628, 645, 670, 691.
 Isambert, 443, 450, 457, 465, 466, 606, 793.
 Isch-Wall, 99.
 Isidore of Seville, 213.
 Israel, 427.
 Itard, 577.
 Ivanoff, 541.
 Ives, 507, 512.
 Jackson, Hughlings, 93, 94, 337.
 Jacob, 102.
 Jacobi, 134, 336, 349, 357, 372, 377, 382, 383, 387, 632.
 Jacquot, 659.
 Jakinovitche, 601.
 Jakins, Percy, 774.
 Jalaguier, 568.
 Janssens, 363.
 Jarvis, 4, 15, 62, 458, 470, 495, 582, 583, 765, 770.
 Jawdyski, 566.
 Jean, 513.
 Jeauty, 155.
 Jelley, R., 521.
 Jenner, 336, 655, 657, 659.
 Jennings, 638.
 Jessop, 528.
 Jewett, 528.
 Joal, 113, 131, 135, 140, 653, 666.
 Johnson, George, 523, 534.
 Johnson, H. A., 488, 742.
 Johnston, Samuel, 505, 522, 528, 604.
 Johnstone, 329.
 Jones, 557, 787.
 Jones, T. Arnalt, 653.
 Joynt, 629.
 Jubel-Renoy, 603.
 Justi, 501, 546.
 Jurasz, 48, 49, 263, 526.
 Jurist, 59.
 Kalindero, 442, 446, 451, 453.
 Kaposi, 185, 414, 415, 416, 421, 441, 445, 446, 607, 636, 731.
 Karlenski, 502, 522.
 Kaurin, 439.
 Keimer, 611.
 Keller, 806.
 Kellogg, 582.
 Kid, 802.
 Killian, 155, 806.
 Kinnear, 75, 85.
 Kirby, 537.
 Kitchen, 580.
 Klebs, 310, 343, 344, 345, 346, 347, 348, 351, 356, 357, 358, 359, 360, 362, 371, 627, 628, 653, 810.
 Klein, 343, 356, 624.
 Knapp, 152.
 Knight, C. H., 43.
 Knight, F. I., 494, 604, 670, 679, 728.
 Koch, Paul, 466, 664.
 Koch, R., 414, 415, 416, 422, 423, 427, 430, 431, 434, 453, 454, 466, 511, 515, 607, 608, 664.
 Köbner, 418, 448.
 Koehler, 513.
 Kölliker, 35, 322.
 Koenig, 416, 430, 566.
 Körner, 140.
 Kohler, 511, 557.
 Kohlrausch, 99.
 Kolopinski, 159.
 Korlovski, 563.
 Kratschmer, 99.
 Kraus, 786.
 Krause, 219, 300, 416, 427, 465, 606, 811.
 Krauss, 482.
 Krieger, 507, 511, 512, 513, 520, 521, 539, 540.
 Krishaber, 318, 339, 341, 507, 523, 581, 586, 773, 774.
 Krönlein, 568.
 Küpper, 137.
 Kussmaul, 248.
 Kuster, 416, 430, 619.
 Labadie-Lagrave, 356.
 Labbé, 514, 647.
 Laborde, 513.
 Labus, 495.
 Lacretelle, 502.
 Laennec, 115, 506.
 La Forge, 84.
 Lagen, 522.
 Lagrave, 351.
 Laidler, 532.
 Lamartinière, 505.
 Lamborn, 577.

- Landgraf, 650, 655, 658.
 Lane, A., 480.
 Langenbeck, 538, 562, 565, 788.
 Langier, 479.
 Langmaid, 458, 459, 461, 464,
 465, 467, 470, 470, 491.
 Lannois, 611.
 Lapeyre, 722.
 Laranza, 466, 666, 667.
 Larghi, 582.
 La Roche, 661.
 Lasègue, 110, 573.
 Lathrop, 487.
 Laurent, 563.
 Lavacherie, 545.
 Lavrand, 139.
 Law, G. E., 494.
 Lawrence, 356.
 Lax, 386.
 Lazarus, 100, 121.
 Lea, 566.
 Leber, 154.
 Lebert, 659.
 Lebouis, 510.
 Leclerc, L., 3.
 Lediard, 564, 617.
 Lee, Robert J., 109.
 Leeper, 538.
 Lefferts, 41, 43, 257, 316, 413,
 418, 422, 480, 483, 508, 512,
 520, 527, 566, 576, 588, 589,
 608, 611, 670, 683, 746, 747,
 749, 750, 751.
 Leflaive, 73.
 Legg, 93.
 Legouest, 34, 553.
 Lejars, 653.
 Leloir, 414, 422, 429, 436, 437,
 438, 439, 443, 445, 448, 449,
 452.
 Leméré, 58.
 Lennander, 644, 645.
 Lenoir, 521, 664.
 Leonard, C. H., 670, 695.
 Lepelletier, 506.
 Lermoyez, 73.
 Leroy, 563.
 Lesbros, 534, 543, 553, 569.
 Lessure, 510, 512.
 Lesser, 430.
 Levis, R., 590.
 Levret, 4.
 Levy, 430.
 Lewin, 646.
 Lewis, 278.
 Leyden, 427, 509, 520.
 Liebermann, 666, 667.
 Lichtwitz, 100, 111, 134.
 Liebermeister, 328, 655, 656.
 Liégeois, 599.
 Linares, 505.
 Lincoln, 631.
 Lindenbaum, 546.
 Line, W. H., 630.
 Little, 542.
 Littlejohn, 501.
 Littlewood, 728.
 Liveing, 642.
 Livon, 465, 467.
 Loder, 93.
 Loeffler, 343, 344, 345, 346, 347,
 348, 351, 357, 358, 359, 360,
 362, 371, 374, 627, 628.
 Loeri, 640, 642.
 Löwe, 103, 135.
 Löwenberg, 61, 161.
 Longuet, 104, 110.
 Loomis, 760.
 Louis, 349, 500, 510, 520, 521,
 655, 657, 794.
 Lovadina, 549.
 Love, I. N., 387.
 Lovett, 410.
 Low, Bruce, 356.
 Lowndes, 34.
 Lublinski, 106, 111, 598, 605,
 611, 657, 664, 665.
 Luc, 418.
 Lucac, 593.
 Lucas, 513, 620.
 Luchsinger, 96.
 Ludwig, 652.
 Lübning, 658.
 Lueddekens, 172.
 Lunn, 214, 218, 219, 221.
 Luschka, 195, 201, 218, 287.
 Lusk, 630.
 Luton, 565.
 Lyon, 502.
 Macalister, 718.
 MacCormac, 505, 539.
 MacCoy, 614.
 MacIntyre, 415, 615.
 Mackenzie, G. Hunter, 139, 766.
 Mackenzie, John N., 41, 43, 49,
 50, 72, 73, 75, 86, 91, 96, 99,
 100, 102, 104, 105, 106, 107,
 108, 109, 110, 113, 115, 122,
 128, 138, 139, 140, 253, 311,
 458, 459, 460, 465, 493, 802.
 Mackenzie, Morell, 4, 9, 11, 12,
 13, 15, 17, 18, 21, 23, 32, 37,
 39, 41, 43, 59, 61, 72, 84, 85,
 87, 88, 137, 159, 166, 172, 221,
 263, 266, 273, 281, 316, 317,
 318, 320, 413, 414, 418, 426,
 430, 436, 437, 441, 443, 445,
 446, 459, 462, 470, 473, 477,
 490, 507, 523, 524, 526, 527,
 533, 539, 542, 543, 549, 550,
 553, 554, 556, 557, 563, 565,
 579, 581, 583, 589, 591, 592,
 593, 594, 599, 600, 606, 613,
 626, 635, 636, 646, 647, 651,
 652, 659, 667, 670, 683, 684,
 688, 700, 707, 708, 713, 724,
 736, 737, 738, 742, 744, 750,
 751, 752, 753, 754, 758, 759,
 760, 761, 764, 765, 768, 769,
 770, 771, 773, 774, 777.
 Mackey, 428, 510.
 MacLean, 538, 541, 543, 544,
 553.
 Madelung, 737, 738, 783.
 Maisch, 386.
 Maisonneuve, 599.
 Maissuriansz, 502.
 Major, 61, 139, 514, 515, 524,
 541, 597, 670, 682, 742, 750,
 751.
 Malbranc, 770.
 Mandl, 259, 315, 428, 435, 613.
 Manfredi, 460.
 Mann, 573.
 Manning, N. S., 631.
 Mantle, A., 466.
 Marais, H., 647.
 Marans, 665.
 Marcel, 140.
 Marckwort, 156.
 Marian, 495.
 Markoe, 562, 568.
 Marrow, 519.
 Marsh, 67, 78, 401, 532.
 Marston, 553.
 Martel, 507.
 Martin, 360, 502, 548.
 Martinache, 307.
 Marty, 413, 417, 421, 607.
 Maselli, 464.
 Masini, 129, 130, 160, 161, 164,
 165, 441, 446, 448, 449.
 Mason, 11, 19, 515.
 Massei, 50, 135, 318, 413, 418,
 428, 465, 502, 506, 541, 646,
 647, 648, 649, 651, 652, 770.
 Massucci, 136.
 Mathieu, 4, 558, 559.
 Maxwell, 59, 129, 510.
 May, 102, 549.
 Mayo, 513.
 McArdle, 568.
 McBride, 135, 267, 341, 594.
 McCarthy, 591.
 McCullough, 83.
 McDonagh, 739.
 McFarlane, 568.
 McGaughey, 510.
 McGuire, 576.
 McKeown, 552.
 McLean, 512.
 McNuer, 58.
 McWheneey, 346.
 Mears, J. E., 505.
 Meigs, 623, 629, 633, 635, 638.
 Meltzer, 522.
 Mènière, 131.
 Menzel, 535, 556.
 Menzies, 355.
 Merkel, 226.
 Merklen, 602, 650, 652, 712.
 Merrigan, 646.
 Mertens, 640.
 Meyer, E. 478.
 Meyer, L., 61, 131, 316, 469,
 495, 528, 541, 545, 550, 577,
 578.
 Michael, 416, 430.
 Michel, 47, 58, 553.
 Middeldorp, 59, 86.
 Mignot, 557.
 Mikulicz, 554, 590, 618, 619.
 Miles, 171.
 Milsonneau, 465.
 Miller, 646, 658.
 Mitter, 537.
 Moe, 558, 559.
 Moldenhauer, 159.
 Mondière, 549.
 Monestier, 548.
 Monroe, 410.
 Montez, 515.
 Monti, 544, 545.
 Moore, 465, 491.
 Morehead, 85.
 Morelli, 770.
 Morgagni, 3.
 Morgan, C., 316, 540, 541, 542,
 610, 719, 730, 759.
 Morgan, J. C., 480.
 Moritz, 431.
 Morrison, 416.
 Morse, 502.
 Moscati, 586.
 Moure, 49, 152, 252, 466, 467,
 479, 587, 588, 759.
 Mouton, 534.
 Moxon, 750.
 Müller, Emile, 501.
 Müller, Johannes, 225.

- Müller, Paul, 110.
 Mules, 155.
 Mulhall, 459.
 Munk, 108, 219.
 Murchison, 654, 655, 659, 660, 661.
 Murrell, W., 108.
 Musehold, 138, 158.
 Mygind, 613, 620.
 Naseloff, 532, 570.
 Natier, 595.
 Neisser, 413, 448, 449, 607.
 Nélaton, 15.
 Netchaieff, 113.
 Netter, 653.
 Nettleship, 154.
 Neumann, 19, 20, 731.
 Newcomb, 597, 598.
 Newman, 484, 506, 510, 613, 769, 774, 783, 787.
 Nicati, 355.
 Nichols, 713.
 Nieden, 129, 152, 157, 161, 163, 172.
 Niemeyer, 331.
 Noquet, 577, 595.
 Norris, W. F., 162.
 North, 41, 140, 521.
 Northrup, 329, 361, 392, 394, 395.
 Notta, 93, 94.
 Nycamp, 597, 698.
 Oatman, 393.
 O'Dwyer, 390, 408, 429, 522, 737, 740, 744, 746.
 Oertel, 328, 349, 351, 388, 514, 523.
 Ogle, 93, 549.
 Olavide, 439.
 Oltszewski, 596, 598.
 Onodi, 91.
 Opitz, 519.
 Oppert, 93.
 Orwin, 412, 717, 728.
 Osler, 540, 546, 624, 654, 655, 656, 657.
 Otto, 726.
 Otz, 510.
 Ouspenski, 576.
 Owen, Edmund, 716.
 Ozanam, 332.
 Packard, J. H., 479, 566.
 Padley, 522.
 Paget, 154, 534.
 Pallucci, 4.
 Palmer, 566.
 Palombieri, 137.
 Panas, 15.
 Paquelin, 590.
 Paré, Ambroise, 586.
 Park, 360, 641.
 Parker, Edward F., 93, 403, 408, 515, 576.
 Parrott, 349, 501, 506.
 Pasteur, 596.
 Pate, 511, 512.
 Paterson, 506, 547, 554, 642, 660.
 Paul, 537.
 Pavloff, 601.
 Payne, 475.
 Péan, 19.
 Penslee, 501, 503.
 Pelletan, 510.
 Peltesohn, 134.
 Pemberton, 503, 506.
 Penny, 553.
 Pepper, Augustus J., 591, 633, 635, 638.
 Pepper, William, 623, 629, 660.
 Perls, 316, 415.
 Perrin, 503, 508.
 Peter, 647.
 Petit, 560.
 Pettit, 521.
 Peyer, 91, 108, 113, 140.
 Peyrot, 594.
 Pfeiffer, 414.
 Phillips, 351.
 Phoebus, 67, 72, 73.
 Pick, T. Pickering, 511, 648.
 Picqué, 501.
 Pieniaczek, 502.
 Pilate, 548, 643.
 Pilcher, L. S., 396.
 Pillot, 548.
 Pipping, 467.
 Pitts, 513.
 Plato, 102.
 Playfair, 630.
 Plenck, 186.
 Plicque, 508, 615.
 Pliny, 102.
 Plumert, 445, 446.
 Poirier, 775.
 Poland, 620.
 Pollisus, 545.
 Politzer, 258.
 Polo, 140.
 Poltauf, 415.
 Pond, E. P., 574.
 Ponfick, 156, 427.
 Poole, T. W., 119.
 Pope Sylvester, 213.
 Porai-Koschitz, 601.
 Portal, 102.
 Porter, 474, 627, 646, 726.
 Post, A. C., 48.
 Posthuma, 503.
 Postnikoff, 545.
 Potain, 578.
 Potter, 140.
 Poulet, 501, 502, 503, 507, 508, 513, 514, 515, 519, 521, 522, 528, 537, 538, 539, 540, 547, 548, 549, 554, 556, 557, 566.
 Powell, 527.
 Power, W. H., 357.
 Prat, 566.
 Predborski, A., 114, 751.
 Pressat, 93.
 Prévost, 93, 98.
 Pritchard, 506.
 Profeta, 439, 440.
 Prudden, 343, 346, 350, 360, 475.
 Puech, 576.
 Putzel, 670, 701.
 Pye, 568.
 Pynchon, 581.
 Quelmaltz, 47.
 Quénu, 532, 582.
 Quinart, 579.
 Quinlan, 130, 171.
 Rampoldi, 130.
 Ransom, 512, 523.
 Rauchfuss, 328.
 Raudnitz, 415.
 Raugé, 109, 726.
 Raulin, 424, 428.
 Ravenel, 520.
 Rayer, 414.
 Rayland, 501, 506.
 Réclus, 594.
 Reed, 641.
 Reeves, 564.
 Regiani, 531.
 Reid, 274.
 Reidlinus, 521.
 Reinard, W., 388, 389.
 Renard, 32.
 Renaudin, 544, 548.
 Rendu, 251, 576, 650, 653.
 Resièyes, 521.
 Réthi, 111, 471, 475.
 Retterer, 194, 197.
 Rewentaver, 385.
 Rheiner, 477.
 Rice, 414, 415, 417, 418, 477, 478, 495, 581, 589, 607.
 Richardson, 505, 567, 570.
 Richardson, B. W., 135.
 Richerand, 322.
 Richet, 15, 17, 568.
 Ricord, 590.
 Ricordeau, 589.
 Riehl, 412, 413, 415, 417, 747.
 Rilliet, 348.
 Ringer, Sydney, 108, 255, 643.
 Risley, S. D., 159.
 Ritter, 346.
 Rivington, 542, 546.
 Roberts, F. T., 539, 622, 623, 642, 655, 660, 661, 668.
 Roberts, J. B., 49.
 Robertson, 4, 59, 565, 713.
 Robin, 599.
 Robinson, Beverley, 42, 43, 48, 59, 61, 88, 89, 129, 259, 272, 273, 458, 462, 463, 464, 491, 662.
 Roche, 540.
 Rochester, 379.
 Rockwell, 512, 525.
 Roddick, 602.
 Roe, 15, 41, 48, 62, 82, 104, 117, 131, 139, 458, 476, 480, 489, 571, 588, 670, 679, 681, 682, 742.
 Roederer, 735.
 Roersch, 568.
 Röse, 384.
 Rokitsansky, 310, 544, 611, 655.
 Rollet, 602.
 Romberg, 109, 132, 133.
 Rosenbach, 131, 513, 628, 658.
 Rosenberg, 606, 811.
 Rosenmüller, 93.
 Rosenthal, 307, 416, 427.
 Ross, 669.
 Rossbach, 106, 372.
 Rostan, 115.
 Roth, 106.
 Rothholtz, 129.
 Rotter, 430.
 Rousseau, 96.
 Routh, 541.
 Roux, 343, 345, 356, 360, 375.
 Ruault, 106, 135, 443, 445, 446, 573, 575, 576, 577.
 Rühle, 252, 502, 507, 633, 635.
 Rükovitch, 658.
 Rumbold, 136, 159.
 Rushmore, 505, 510, 532.
 Ryland, 649.
 Sabatier, 58.
 Sadebeck, 598.
 Saenger, 22.
 Saint Ambrose, 213.
 Saint-Germain, 581, 594.
 Saint Gregory, 213.

- Sajous, 9, 43, 73, 86, 467, 479, 495, 583, 594, 649.
 Salicet, William of, 3.
 Salkowski, 387.
 Sallinger, 134, 135.
 Salmuth, 102.
 Salter, 115.
 Sanders, 513.
 Sanderson, Burdon, 119, 311, 512.
 Sanford, 561.
 Sandwith, 663.
 Sands, 506, 591.
 Sanné, 352, 378, 387, 396, 398.
 Santwood, 420.
 Sappey, 8, 93.
 Sarycheff, 568.
 Saucerotte, 549.
 Savitzky, 543.
 Schadewaldt, 252, 523, 524.
 Schadle, 111.
 Schaeffer, Max, 15, 49, 104, 105, 106, 114, 115, 131, 156.
 Schech, 4, 13, 48, 59, 106, 111, 113, 121, 128, 134, 260, 261, 264.
 Schede, 416.
 Scheinmann, 111.
 Schenck, 504.
 Schenker, 385.
 Scherschewsky, 465.
 Schiffers, 466.
 Schimmelbusch, 430.
 Schirmer, 165.
 Schlemmer, 118.
 Schley, 433.
 Schmaltz, 105, 106, 110, 135.
 Schmidt, 316, 431, 525, 576.
 Schmidtborn, 166.
 Schmidt-Rimpler, 130, 156, 165.
 Schmiegelow, 108, 110, 117, 139.
 Schneider, 96, 135.
 Schnitzler, 104, 406, 475, 479, 483, 671, 770, 802.
 Schoetz, 495.
 Schreiber, 106, 141.
 Schroeder, 102, 258.
 Schrötter, 41, 315, 316, 317, 320, 413, 429, 461, 477, 485, 502, 503, 505, 508, 515, 562, 735, 736, 744, 745, 746.
 Schüler, Max, 422.
 Schuler, 593.
 Schubert, 656.
 Schwartz, 650, 652.
 Schwimmer, 607.
 Schwitzen, 731.
 Secchi, 137.
 Secrétan, 638.
 Sedziak, 49.
 Séé, 186, 117, 458, 542, 546.
 Segond, 568.
 Seibert, 377.
 Seifert, 113, 128, 134, 598, 735, 770.
 Seiler, Carl, 4, 15, 42, 43, 48, 103, 110, 128, 139, 459, 464, 480, 491, 579, 580, 670, 694, 770, 794.
 Seiler, Emma, 224.
 Seiss, R. W., 164.
 Seitz, 307.
 Selby, 564.
 Semeleder, 321, 480, 647.
 Semon, Felix, 138, 214, 219, 227, 241, 265, 339, 482, 494, 508, 577, 652, 688, 689, 760, 767, 768, 770, 771, 774.
 Senator, 265, 650, 651, 652.
 Sendler, 528.
 Senenko, 506.
 Senert, 510.
 Sestier, 317, 652.
 Sevestre, 343, 346, 348.
 Shackelford, 510.
 Shann, 549.
 Shattock, 760, 770.
 Shaw, 576, 577.
 Sheppard, 510.
 Shoemaker, 543.
 Shurly, 318, 482.
 Sigel, 384.
 Silver, H. M., 544, 552, 553.
 Simanowski, 548.
 Simon, Jules, 343, 369, 373, 374, 381, 382, 384, 387, 646, 647.
 Simpson, 666, 667.
 Sims, Marion, 141.
 Sipe, 503.
 Sirédey, 349.
 Sivers, 698.
 Skey, 534.
 Sklifosovski, 535, 568.
 Smith, A. A., 389.
 Smith, A. H., 43, 458, 474, 512.
 Smith, Charles, 367, 368.
 Smith, Gilbert, 733.
 Smith, J. L., 623, 626, 627, 628, 629, 630, 631, 632, 633, 640, 642, 660, 661.
 Smith, Priestley, 154, 158.
 Smith, S. S., 387.
 Smith, Thomas, 529, 556.
 Smolitschew, 502, 522.
 Snow, H. L., 387.
 Sokolowski, 571.
 Soltmann, 339.
 Sommerbrodt, 108, 110, 121, 131, 477.
 Sonnenburg, 265, 431, 652.
 Southam, 568.
 Sowers, 565.
 Spencer, 641.
 Spillmann, 4.
 Sprengel, 509.
 Squibb, E. R., 368, 376.
 Squire, B., 186, 662.
 Squires, Wm., 329, 330.
 Stanski, 519.
 Starr, 638.
 Steavenson, 503.
 Steele, 49, 57.
 Steffen, 336, 338.
 Stein, Stanislaus von, 137.
 Steinbrügge, 15.
 Sternberg, 353.
 Stevens, 549.
 Stewart, 537, 566.
 Stillé, 386, 661.
 Stimson, 538.
 Stockton, 461.
 Stoerk, 4, 61, 116, 117, 264, 312, 315, 429.
 Stoessel, Hiero, 519.
 Stoffella, 639.
 Stohr, 279.
 Stoker, 48, 50, 138, 783.
 Stokes, 501, 508.
 Strasser, 510.
 Strassmann, 605.
 Stricker, 223.
 Stroem, 515, 538, 568.
 Stromeyer, 541.
 Strübing, 316, 317.
 Strümpel, 622, 630, 634, 644, 654, 655, 660.
 Strumpf, 383.
 Subbotic, 534, 566.
 Sutherland, 506.
 Sutton, Bland, 510, 726, 738.
 Svanson, 514, 527.
 Sykes, 502.
 Sylvius, 138.
 Syme, 563.
 Symson, 539.
 Szadek, 600.
 Tappan, 381, 382.
 Tauber, 506, 770.
 Taylor, Frederic, 722.
 Taylor, L. H., 129, 160, 162, 445, 446, 601.
 Tcherniaeff, 627.
 Terillon, 568.
 Terpander of Lesbos, 213.
 Thacher, 389.
 Thiersch, 430.
 Thin, 447, 448.
 Thomas, 486, 622, 623, 628, 629, 638, 640, 642.
 Thompson, 137, 509, 512, 538, 564.
 Thorburn, 617.
 Thorne, 272, 525, 542, 652, 670, 672, 742.
 Thrasher, 113.
 Thudichum, 4.
 Tigri, 349, 663.
 Tillaux, 398.
 Tissier, 802.
 Tobin, 568.
 Tobold, 322, 413, 429, 446.
 Todd, 643.
 Toison, 583, 584.
 Tornwaldt, 71, 106, 111, 131.
 Torrance, 563.
 Traube, 121.
 Trendelenburg, 351, 565, 787.
 Trifiletti, 109.
 Trolard, 534.
 Trouseau, 96, 115, 116, 122, 129, 161, 268, 270, 272, 344, 370, 371, 396, 398, 636, 643, 647, 657.
 Türk, 312, 316, 317, 318, 413, 470, 472, 473, 482, 700, 806.
 Turner, 355, 357.
 Tush, 544.
 Tyler, 511.
 Tymowski, 484.
 Tyndall, 218, 219.
 Tyrmann, 154, 155, 157.
 Tyrtaeus, 213.
 Unna, 258, 448, 452.
 Urban, 430, 431.
 Ure, 17.
 Usiglio, 556.
 Valat, 581, 599.
 Valentine, 93.
 Valsalva, 3.
 Vanderpoel, 15, 597, 598.
 Van de Warker, 546.
 Van Helmont, 66, 96, 102.
 Vanlair, 132.
 Van Meek'ren, 9.
 Velpeau, 589, 619.
 Verdos, 577.
 Vergely, 633.
 Verneuil, 15, 17, 19, 40.
 Vialle, 271.
 Vidal, 186, 421.

- Viennois, 19.
 Vierordt, 466.
 Vicusse, 502.
 Vigla, 545.
 Vilcoq, 664.
 Villar, 612, 721.
 Virchow, 35, 265, 306, 346, 423,
 447, 448, 469, 477, 611, 651,
 747, 772.
 Voelcker, 507.
 Volgnarius, 545.
 Volkmann, 23.
 Volland, 513.
 Voltolini, 2, 4, 49, 58, 59, 101,
 103, 115, 525, 526, 763.
 Von Focke, 373.
 Von Hacker, 554.
 Von Hoffmann, 317.
 Von Klein, 695, 696.
 Von Troeltsch, 782.
 Von Wahl, 568.
 Vul'pian, 307.
 Vysokovitch, 627.
 Wagner, Clinton, 474, 490, 589,
 770.
 Wagner, R., 15, 42, 213, 269,
 278, 572, 573, 576, 799.
 Wagner, 445.
 Walker, 565.
 Wallace, James, 160, 169, 546.
 Walsham, 49.
 Walshe, 549.
 Walther, 502, 539, 540.
 Ward, 528.
 Warden, 91.
 Warren, J. M., 506, 510.
 Watson, P. H., 49, 163, 329,
 679, 785.
 Watts, 542, 548.
 Waxham, 395.
 Weber, 116, 117.
 Weichselbaum, 664.
 Weigert, 328, 349.
 Weinlechner, 556.
 Weir, 503, 505, 512, 531, 535,
 586.
 Weiss, 415, 494, 522.
 Weist, 517, 518.
 Weiszbarth, 513.
 Welch, 343, 622, 631, 634, 640,
 644, 653, 660, 663.
 Welcher, 383.
 Welcker, 153.
 Wells, 528.
 Welsh, 660.
 Wendt, 258.
 Werner, P., 382, 587.
 Wetmore, 333.
 Wharton, 407, 408, 502, 513,
 519, 528.
 Wheeler, F. T., 355, 527, 567.
 Whistler, 523, 525, 745.
 White, George, 534, 537, 545.
 White, Hale, 726.
 White, J. A., 129, 503, 523,
 548.
 Whitehead, 787.
 Whittier, 381.
 Whyte, Robert, 102.
 Wight, 568.
 Wilde, 4.
 Wilkinson, 540.
 Willard, De Forest, 532.
 Wille, 111.
 Willis, 138.
 Wilson, 515, 536.
 Wing, 464.
 Wingrave, 612, 720.
 Winternitz, 502, 522.
 Witte, 512.
 Woakes, 4, 10, 43, 59, 98, 110,
 112, 307, 308.
 Wolf, 446, 480.
 Wolfenden, 426, 613, 614, 619,
 665, 722, 812.
 Wood, C. A., 154.
 Wood, George B., 359.
 Wray, 501.
 Wright, Jonathan, 48, 61, 256,
 568, 583, 584, 604.
 Wunderlich, 647.
 Wurtz, 346, 628.
 Wurzer, 599.
 Wyeth, 502, 504, 528, 529.
 Wyman, 67, 73, 78, 80.
 Wyss, 660.
 Yearsley, 574.
 Yersin, 343, 345, 356, 360, 375.
 Zahn, 356.
 Zaufal, 58.
 Zawarakin, 572.
 Zeleneff, 601.
 Zeman, 548.
 Ziegler, 415.
 Ziem, 96, 129, 130, 140, 153,
 155, 156, 168, 169.
 Ziemssen, 248, 312, 322, 412,
 413, 418, 426, 428, 459, 462,
 477, 484, 512, 639, 640, 647,
 654, 660, 661, 683, 685, 693,
 771, 777.
 Zuckerkandl, 4, 8, 9, 13, 15, 37,
 38, 92, 99.
 Zuelzer, 647.
 Zwaardemaker, H., 92, 93, 95.
 Zwilling, 446.
 Zwinger, 515.

SYSTEM OF DISEASES

OF THE

EAR, NOSE, AND THROAT.

PART II.

Diseases of the Nose and Naso-Pharynx.

(CONTINUED.)

MORBID GROWTHS AND DEFORMITIES OF THE NASAL CAVITIES:

PATHOLOGY, ETIOLOGY, PHYSIOLOGY, AND DIFFERENTIAL DIAGNOSIS.

BY CARL SEILER, M.D.,

Lecturer on Laryngology in the University of Pennsylvania; Chief of the Throat Dispensary in the University Hospital; Late Curator of the Pathological Society, etc., Philadelphia.

INTRODUCTION.

THE subject of tumors and neoplasms in the nasal cavities is one of great interest, and at the same time a very difficult one to discuss intelligently in a short treatise, such as necessarily must be given in the following pages.

The difficulty lies chiefly in the fact that true neoplasms may be, and frequently are, confounded with hyperplasias, hypertrophies, or deviations from the normal contours of the bony framework forming the nasal cavities. This difficulty must therefore be overcome by including these deformities, hypertrophies, hyperplasias, and even foreign bodies and rhinoliths, in the list of tumors, so as to be able to give a clear understanding and comprehensive view of the differential diagnosis in the respective cases of nasal obstruction; because tumors and neoplasms situated in the nasal cavities must necessarily obstruct free nasal respiration by their very presence.

It is therefore reasonable to consider in detail other obstructions which are not tumors or neoplasms in the strict sense of the words; also to include the rare aggregation of calcareous matter around a nucleus formed by a foreign body as a neoplasm, or a new formation, which by its presence obstructs and cannot be expelled by the ordinary natural effort of forcible expiration. But the hardened excretions so often met with in atrophic rhinitis, although they obstruct, cannot be logically or reasonably included in the list, because their removal does not require surgical interference, but is accomplished sooner or later by the natural efforts of the patient.

According to Dunglison, a neoplasm is "a new formation or tissue, the product of morbid action;" in other words, it is a pathological aggregation of tissue-elements, either foreign to the tissue in which it occurs, or else a superfluous and superabundant accumulation of the same tissue-elements; and we term the latter an hypertrophy. A tumor, on the other hand, is defined by Boyer (Dunglison) as "any preternatural eminence developed on any part of the body," which means that a tumor is a pathological aggregation of either like or unlike tissue-elements producing an elevation, and in this one characteristic—namely, elevation above the surface—consists the difference between neoplasm and tumor.

The tumors, as defined above, which occur within the nasal cavities are divided, for the sake of convenience of description as well as clearness of understanding, into two large classes, considered from the stand-point of the clinician. These classes are first the benign tumors, which, clinically speaking, do not produce death by metastasis, and secondly the cancerous tumors, which latter are again divided histologically into the connective-tissue, or sarcomatous, and the epithelial, or carcinomatous, tumors.

HISTORY OF TUMORS.

Perhaps the first mention of tumors made in medical literature is an account of several cases of nasal polypi by Hippocrates,¹ who describes the method of removal which was adopted and advocated by Voltolini for the removal of tumors in the larynx,—viz., by quickly and forcibly drawing a piece of sponge attached to a string through the nasal cavities from behind forward. Celsus² advocated their removal by actual cautery with a hot iron. Galen³ recommended astringent solutions or powders. Aetius⁴ also recognized them as tumors, and employed caustics. Paul of Ægina⁵ was the first to mention the necessity of dilating the nostril, which he accomplished with the thumb and index-finger of the left hand, while he employed a peculiarly-shaped scalpel with the right hand to cut the attach-

¹ De Morbis, lib. ii., Littré's ed., Paris, 1851, vol. vii. p. 51.

² De Medicinâ, lib. vi. cap. viii.

³ De Comp. Pharm. sec. Locos, lib. iii. cap. iii.

⁴ Tetrabibl., ii. serm. ii. cap. lxxxix.

⁵ Lib. vi. cap. xxv.

ments of the tumors. Abulcasis¹ used forceps to draw out the excrescences, after which he cut off the protruding portion and scraped the seat of origin of the tumor. Guy de Chauliac² employed forceps and removed the tumors by evulsion, as general surgeons perform the operation at the present day. William of Salicet³ introduced the plan of strangulation of nasal growths by tying a ligature tightly around the pedicle. The channel of the nose was widened by means of sponge tents or serpentaria root. The tumor was then tied tightly with doubled silk as near the root as possible. The growth was extirpated by evulsion with forceps, and the stump destroyed by corrosive applications or actual cautery. Arantius⁴ was not satisfied with knife-treatment. He also invented blunt forceps with which he tore away the growth, and always operated in a dark room, a round hole in the shutter only allowing the sunlight to fall on the patient's nose. On a dull day, a lighted candle placed behind a glass flask full of water was the illuminating method. Fabricius ab Aquapendente⁵ claimed to be the originator of an instrument for the removal of tumors, which consisted of a pair of forceps, the cutting blades of which were deeply hollowed, so that when closed the instrument formed a kind of canula, through which a hot iron could be passed or powder blown. Fabricius declared that his instrument was designed to cut growths without the dangers attending the use of the *spatha*, or ancient scalpel. He may therefore be termed the inventor of the "cutting forceps."

In 1628 Glandorp⁶ published an erudite treatise on tumors and nose affections, and Boerhaave⁷ subsequently propounded a theory that nasal polypi were formed by a prolongation of the lining membrane of the pituitary sinuses. He argued that the secretion in one of the cells, becoming from some cause or other too thick, does not escape properly from the cavity, which thus becomes filled up, till its lining membrane is protruded into the nasal fossa, where it is suspended as a membranous sac filled with fluid or semi-fluid contents. Heister⁸ also propounded the theory that nasal polypi were formed by the obstruction of one or more of the glands of the pituitary membrane, leading to the formation of a tumor.

Morgagni⁹ quoted and approved Valsalva's method of removing the

¹ Lib. ii. cap. xxiv. (*Chirurgie d'Abulcasis*, traduite par le Dr. Lucien Leclerc), Paris, 1861, p. 93 *et seq.*

² Le Guydon (Guy) en François, par Maître Jean Camappe, Lyon, 1538, fol. 198.

³ *Chirurgia* Gulielmo de Saliceto, in *Ars Chirurgica* Guidonis Cauliaci, Venetiis, 1546, p. 308.

⁴ *De Tumoribus præter Naturam*, Appendix to his *Treatise De Humano Fœtu*, Venetiis, 1587, p. 170 *et seq.*

⁵ *Operationes Chirurgicæ*, cap. xxiv., in *Opera Chirurgica*, Lugduni Batavorum, 1723, p. 438 *et seq.*

⁶ *Tractatus de Polypo*, Bremen, 1628, cap. vii.

⁷ *Prelectiones ad Institutiones*, cap. 8, 498.

⁸ *General System of Surgery*, English translation, London, 1743, pt. ii., p. 437 *et seq.*

⁹ *De Sedibus et Causis Morborum*, ed. sec., Patavii, 1765, Epist. xiv. sec. 19, 20.

lamella of bone on which the tumor grows, with the view of preventing recurrence. Levret,¹ when he turned his attention to nasal growths, invented several ingenious instruments for applying and tightening ligatures. Pallucci² was considered one of the most successful operators in this branch of surgery, and he essayed to improve upon Levret's methods. In 1805 Robertson of Edinburgh published a drawing of an instrument for snaring nasal tumors, and upon this Wilde modelled his aural snare, which was later on modified by Hilton so that it might be used for the nose to better advantage. In later days interesting treatises on the subject have been published by Gruner,³ Dzondi,⁴ W. Colles,⁵ Mathieu,⁶ Thudichum,⁷ Durham,⁸ and Spillmann,⁹ and also valuable treatises by Zuckerkandl¹⁰ and Woakes.¹¹

Since the general introduction of the rhinoscope, and the more modern and improved methods of examining the nasal cavities, the literature on intra-nasal neoplasms has multiplied to such an extent that but a few of the more important writers need be mentioned in this short sketch. First and foremost among the English are Sir Morell Mackenzie,¹² Woakes,¹³ and Lennox Browne;¹⁴ in Germany, Voltolini,¹⁵ Schech,¹⁶ and Stoerk;¹⁷ and in America, J. Solis Cohen,¹⁸ Bosworth,¹⁹ Jarvis,²⁰ and Seiler,²¹ all of whom have embodied their contributions to the literature either in text-books on rhinology and laryngology or in extensive monographs. And the medical journals of the day are replete with more or less extended papers and descriptions of interesting cases of intra-nasal neoplasms, by various authors.

GENERAL ETIOLOGY.

The peculiar anatomical relationship of the parts, the still more peculiar histological structure of the soft tissues within the nasal cavities, and also the unusual distribution of glands and blood-vessels, together with the

¹ Obs. sur la Cure radicale de plusieurs Polypes, Paris, 1771, 3d ed., p. 214 *et seq.*

² Ratio facilis atque tuta Narium curandi Polypos, Vienna, 1763.

³ De Polypis in Cavo Narium obviis, Lipsiæ, 1825.

⁴ Ergo Polypi Narium nequaquam extrahendi, Halæ, 1830.

⁵ Nasal Polypi, Dublin Quart. Journ. of Med. Sci., November, 1848, p. 373 *et seq.*

⁶ Sur les Polypes muqueux des Arrière-narines, Thèse de Paris, 1875.

⁷ On Polypus in the Nose, etc., London, 1869; 3d ed., 1877.

⁸ Holmes's System of Surgery, vol. iv.

⁹ Dict. Encyclop. des Sciences Médicales, art. Nez.

¹⁰ Normale u. Pathol. Anatomie der Nasenhöhle, Wien, 1882, p. 64 *et seq.*

¹¹ Post-Nasal Catarrh, Am. ed., Philadelphia, 1867.

¹² Diseases of the Throat and Nose, London, 1884.

¹³ Post-Nasal Catarrh, Am. ed., Philadelphia, 1884.

¹⁴ The Throat and its Diseases, London, 1878.

¹⁵ Die Galvanokaustik, Breslau, 1867.

¹⁶ Diseases of the Mouth, Throat, and Nose, Eng. ed., Edinburgh, 1886.

¹⁷ Wiener Medicinische Wochenschrift, 1886.

¹⁸ Diseases of the Throat and Nasal Passages, New York, 1879; 2d ed.

¹⁹ Diseases of the Throat and Nose, New York, 1881.

²⁰ Archives of Laryngology, vol. ii.

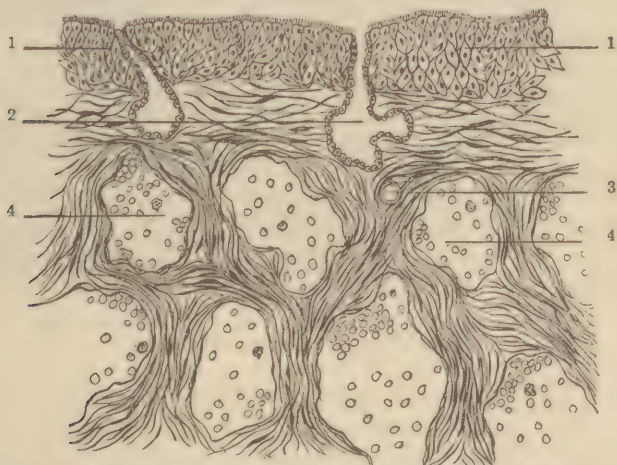
²¹ Diseases of the Throat and Nose, 3d ed., 1889.

physiological functions of the organ, must be recapitulated, in a few words. Such recapitulation is necessary in order to appreciate fully the special peculiarities of intra-nasal neoplasms,—the reason why some, which are most common in other parts of the respiratory tract, are seldom found in the nose, while on the other hand some, most commonly met with in the nose, are hardly ever seen in other parts of the body.

For instance, there are but few cases of intra-nasal papillomata on record, while warty growths are the most common kind of neoplasms in the larynx. And, on the other hand, where, except occasionally in the vagina, do we meet with a mucoid polypus, which is the most common form of intra-nasal neoplasm?

Let us first consider the peculiarities of the mucous membrane lining the nasal cavities, and recall the histological details by which it differs from mucous membranes in other parts of the body. A microscopical examination of a transverse section of some of the soft tissues of the nasal cavities, under a moderately high power,—about five hundred diameters,—presents a picture at variance with similar sections from other portions of the upper respiratory tract; and so striking is this difference that no skilled observer could hesitate a moment to pronounce the section to be from the interior of the nose. (Fig. 1.)

FIG. 1.



TRANSVERSE SECTION OF ERECTILE TURBINATED TISSUE. $\times 500$.—1, epithelial layer; 2, mucous glands; 3, capillary vessel; 4, 4, venous sinuses.

In the first place, the epithelial layer, composed as it is of columnar epithelium, ciliated in most parts of the nasal cavities, but without cilia in the upper, or olfactory, region, is very much less deep here than elsewhere in the body. The contour of the upper surface of this epithelial layer, as well as of its base, is smooth, and papillæ are met with only near the lower and external portion of the anterior nasal cavities,—viz., that portion of the mucous membrane which gradually merges into skin, through the inter-

mediate integument, lining the vestibule of the nose. The basement membrane separating the epithelial layer from the submucosa is extremely thin, and so is the submucosa itself, being composed of but a scant mesh-work of connective-tissue fibres and a very delicate net-work of capillaries; unlike the submucosa of the trachea, for instance, or, still more strikingly, of the small intestines, in which localities both the epithelial layer and the submucosa are very deep and give ample room for the excretory glands.

In those portions of the nasal mucous membrane overlying the turbinated bones, and also the lower portion of the cartilaginous plate of the septum, we find a peculiar tissue immediately below the submucosa, and in no way separated from it by any membrane or sheath. This tissue is composed of a net-work of strands of connective-tissue fibres of both the white and yellow elastic varieties, the meshes of which net-work form large open spaces of variable shape and size, which are lined with endothelium, and in the living tissue are filled with venous blood, thus presenting a very similar picture to a section of the corpora cavernosa, or other erectile tissue, in other portions of the body, as first described by Bigelow. (Fig. 2.)

FIG. 2.



Section of the cavernous or erectile tissue of the middle and lower turbinated bones, inflated and dried, $\times 2$ diameters (Bigelow).

The resemblance to the true erectile tissue is still further borne out by the facts that the venous sinuses communicate directly with the arterioles, without the intervention of capillaries, and also that the capillary circulation of the connective-tissue framework is very scant.

The physiological functions of the nasal organ are threefold, or, better expressed, consist of three different and distinct functions which make the nose one of the most important organs of the human economy, and naturally any interference with these functions will have a most important pathological bearing upon the whole system; for when respiration, perhaps the most vital function of organic life, is abrogated even in a minor degree, all other functions of the system, in either plants or animals, will be interfered with, to a greater or lesser extent. The interchange of carbonic acid

and oxygen is alike necessary in plants and animals, and is more important than the supply of food, because life may be sustained for a number of days, or weeks even, without supplying new material for cell-growth, but if carbonic acid accumulates and oxygen is withheld but for a few minutes, life becomes extinct.

Thus nasal neoplasms, as defined, by their presence more or less obstruct the nasal chambers, and thereby interfere with proper nasal respiration. To understand this clearly, let us in a few words recall the functions of the nose as a respiratory organ, as well as its other two functions,—viz., the accessory resonance to the voice, and the site of the organ of smell. The short description given above of the histological structure of the nasal mucous membrane, with its underlying turbinated erectile tissue, clearly indicates, what has been proved by experiment, that the air *inspired* in its passage through the nasal chambers must become warmed by its contact with the large expanse of tissue and its nearness to the venous sinuses, in a similar manner as the air of a room is raised in temperature by its passage between the coils of a steam radiator.

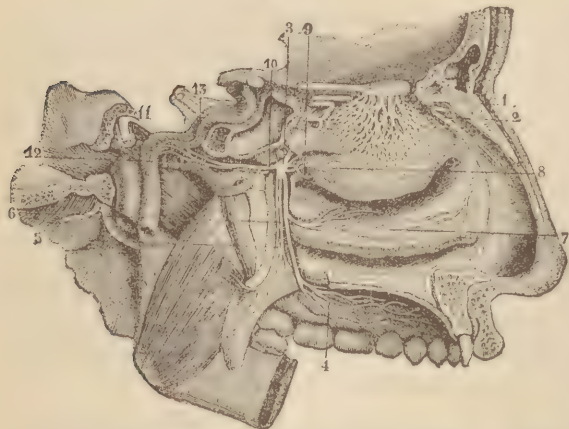
The abundant mucilaginous secretion which continually suffuses the mucous membrane gives off part of its moisture to the air passing through the nares, and thus it is saturated to the dew-point. And, finally, this very same secretion acts as a purifier, because those fine particles of dust or foreign matter floating in the air, which have passed through the sieve of the vibrissæ, are engaged on the sticky surface of the mucous membrane, and the air thus passes through the pharynx and larynx into the trachea and lungs warmed, moistened, and filtered free from dust.

The next function—of minor importance, however—is what is termed nasal resonance, and consists simply in the addition of vocal power by the reverberation of the air contained within the nasal cavities during the act of vocalization, in the same manner as the air contained in the cavity of a violin by its reverberation increases and modifies the sound given forth by the strings. Again, the air contained in the cavity must be in direct communication with the outer air, but not in direct communication with the string producing the vibration. In the violin the so-called *f* holes¹ allow the air to communicate with the reverberations within the cavity, and the strings communicate their vibration to this cavity through the medium of the resonance-cover. In the nose the nostrils communicate with the outer air, and, the soft palate closing the posterior nares in vocalization, the vibration of the vocal cords is communicated to the air contained in the nasal cavities through the hard palate.

If in either case the *f* holes of the violin or the nostrils are obstructed, the resonance is lost according to the degree of the obstruction. This fact gives the careful observer a valuable means of diagnosis in nasal obstructions and neoplasms.

¹ The *f* holes are openings in the resonance-cover or belly of stringed instruments, shaped like an italic *f*.

The third function of the nose, which is rather a negative one, is that its upper anterior portion is the seat of the sense of smell, inasmuch as the sensitive fibrillæ of the olfactory nerve are spread out in a fan shape over the upper portion of the septum and the upper third of the middle turbinated bone opposite. (Fig. 3.)



SECTION OF NASAL CAVITIES, SHOWING NERVE-SUPPLY. SPHENO-PALATINE GANGLION, SEEN ON ITS INTERNAL SURFACE (Sappey).—

1. Terminal branches of the olfactory nerve; 2, external division of the ethmoidal branch of the nasal nerve; 3, sphenopalatine ganglion; 4, termination of the great palatine nerve; 5, posterior palatine nerve; 6, middle palatine nerve; 7, branch of the great palatine nerve supplying the lower turbinated bone; 8, branch from the sphenopalatine ganglion to the middle turbinated bone; 9, origin of the branch from this ganglion to the septum; 10, Vidian nerve; 11, great superficial petrosal nerve; 12, carotid branch of the Vidian nerve communicating with the corresponding branch of the superior cervical ganglion; 13, carotid branch of the superior cervical ganglion.

is prevented by obstructions due to neoplasms, hypertrophies, foreign bodies, etc.

POLYPI.

The most common form of intra-nasal neoplasms observed is that form usually termed polypus. Its very name, which is derived from the Greek, meaning "many-footed," and which has been applied to certain marine and fresh-water mollusks, indicates that the earliest observers, who gave the name to this neoplasm, were not familiar with either its histology or its etiology, and named it so merely from its resemblance to the translucent mollusk, and from its tendency to recur after apparent total removal.

Clinically, as well as from a histological and pathological point of view, we must recognize three distinct varieties of this benign neoplasm. Although Zuckerkandl¹ gives five different forms, yet I am in harmony with Bosworth when he says "he [Zuckerkandl] goes beyond the field." The explanation of this apparent discrepancy lies in the fact that Zuckerkandl

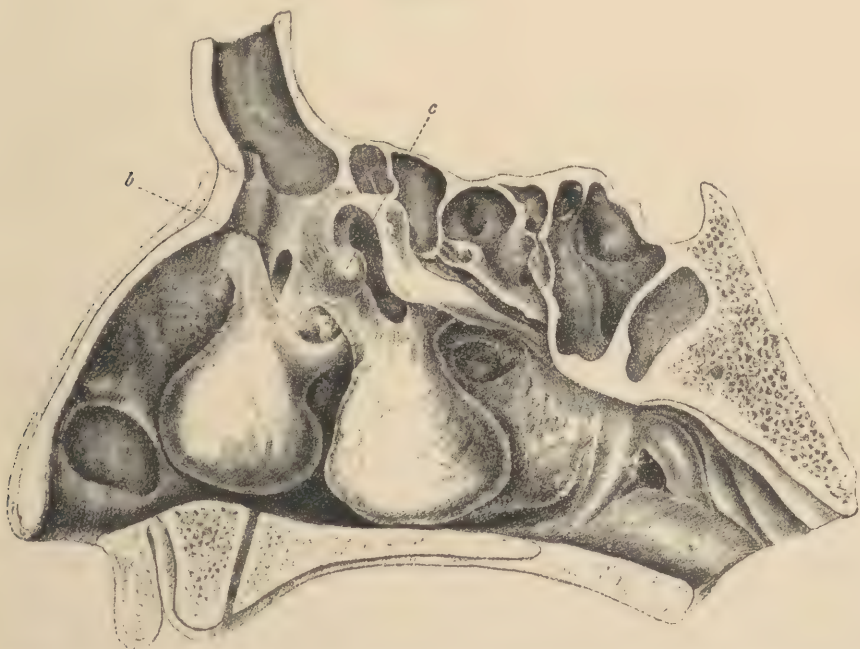
¹ Op cit., p. 64 *et seq.*

FIG. 4.



LEFT NASAL WITH HYPERTROPHY OF THE MUCOUS MEMBRANE (Zuckerkindl).—*a*, indentation in the lower turbinated body; *b*, lobulated tumors on the edges of the indentation; *c*, warty tumor on the inferior turbinated body.

FIG. 5.



RIGHT NASAL CHAMBER CONTAINING TWO LARGE POLYPI (Zuckerkindl).—*b*, infundibulum; *c*, cyst of the mucous membrane.

derived his knowledge from pathological specimens post mortem, most of which had been for years preserved in alcohol, while Bosworth and others, among them the writer, arrived at their conclusions by clinical observations and microscopical examination of pathological specimens obtained by operations on living subjects. What Zuckerkandl terms "polypoese Wucherungen" (polypoid excrescences) are not in a living subject to be classed with or mistaken for any of the three varieties of polypi, but were, in all probability, the shrivelled and distorted masses of hypertrophied turbinated tissue as seen after death in a preserved specimen.

Mucous Polypi.—The first variety of polypi to be considered is the ordinary mucous polypus so frequently met with, and so easily recognized by its peculiar and characteristic resemblance to a small oyster or mollusk. With the ordinary light employed in rhinoscopy, whether artificial or natural, it is seen to present a glistening surface of a pearl-gray or grayish-pink color, and, if not subjected to pressure by the adjacent parts, is of the form of a pear. In many cases these neoplasms protrude from the nostrils, or hang down into the post-nasal or naso-pharyngeal cavity, and have the peculiar property of absorbing moisture from the atmosphere, so that their bulk is increased and they protrude more in damp weather than when the atmosphere is dry. In other cases, of not as long standing, they will not be seen at the anterior or posterior orifices of the nasal cavities, but may, like other intra-nasal neoplasms, cause a swelling and lateral enlargement of the external nose.

Very frequently they give rise to spontaneous epistaxis, as well as obstruction to nasal respiration, which, owing to the hygroscopic properties above mentioned, increases in damp weather; to loss of the sense of smell, in a greater or less degree, and to the accumulation of a viscid, muco-purulent, sometimes sanguineous discharge, which oozes from the nostrils, as it cannot be blown out, and frequently excoriates the skin by its acidity.

The usual symptoms due to obstruction of nasal respiration—viz., dryness of the pharynx, irritability of the laryngeal mucous membrane, and want of nasal vocal resonance, making the voice sound what is erroneously called nasal—are present to a greater or less extent in all cases.

In the foregoing pages the different theories entertained by the older observers have been already indicated, and a few words will suffice to give the opinions of our modern rhinologists as to the origin and causation of these peculiar neoplasms. Mackenzie¹ says that the etiology is quite unknown. Sajous² attributes mucoid polypi to chronic inflammation of the Schneiderian membrane. Van Meek'ren³ quotes a case of polypi as caused by the introduction of a splinter of wood into the nasal mucous membrane, and Gerdy⁴ attributes their origin to fracture of the septum; while

¹ Op. cit., p. 352.

² Medical and Surgical Reporter, 1881.

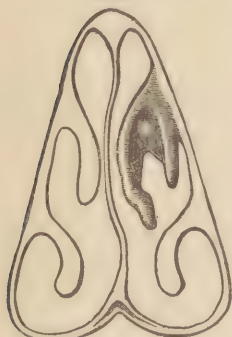
³ Quoted by Morgagni, loc. cit.

⁴ Des Polypes et de leur Traitement, Paris, 1833.

Woakes¹ gives us perhaps the most plausible theory of the causation and origin of nasal mucoid polypi, which the writer can endorse and fully accept, not only as a theory, but as a fact demonstrated by clinical as well as pathological observations.

In a few words, his theory is that in a long-standing chronic nasal catarrh of the hypertrophic variety it frequently happens that the middle turbinated bone returns to its embryonic condition; that is to say, it becomes cleft into two portions, the two sides being parallel with each other, and the split in the bone running from before backward. At first the inner aspects of these two portions of the bone are covered with the normal mucous membrane, which follows the cleaving and becomes thus invagi-

Fig. 6.



Cleft middle turbinated bone
(Woakes).

nated in a similar way as skin is in a dermoid cyst. Gradually, by pressure cutting off the proper blood-supply, and owing to the retention and consequent putrefaction of the normal secretion, the mucous membrane within the cleft becomes ulcerated and the bone denuded. The necrosis of the bone, however, does not, as is generally the case, cause sequestration, but, owing to the peculiar cancellated structure of the turbinated bones, small spicules of bone are thrown out, and the natural process of repair by granulation, springing from the still unaffected portions of the mucous membrane, covers these spicules. The blood-supply not being sufficient, however, true

mucous membrane is not formed, but in its stead a myxomatous structure accumulates around them, which by its gradual enlargement increases the space between the two portions of the middle turbinated bone to such an extent that finally these mucoid neoplasms come in contact with the air-current, whereby their surface becomes hardened, the pressure is somewhat relieved, and epithelium begins to grow on their surface.

Of course the lower polypi, having more space to expand, rapidly enlarge, while those in the upper portion of the cleft grow more slowly, but as they grow they also push (Fig. 6), by their expansion, the lower ones into the respiratory portion of the nasal chambers, and thus the obstruction of the nose is gradually increased until total occlusion is accomplished.

The histological features presented by a section under the microscope are very simple, as we observe nothing but the epithelium on the surface, the large meshes of delicate connective-tissue fibres containing the mucus, and delicate capillaries in this net-work, without walls or endothelium. Near the base or pedicle of the polypus the blood-vessels are somewhat larger, and the connective-tissue fibres are collected in parallel strands which emanate from the periosteum of the spicules of bone. Occasionally

¹ Op. cit., p. 190 *et seq.*

FIG 7.



Several nasal polypi with slender pedicles (Zuckerkindl).

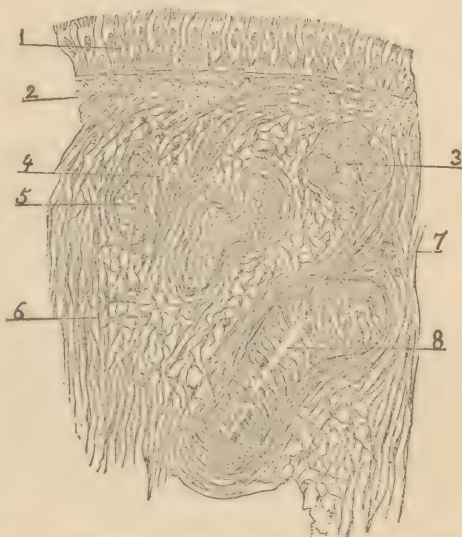
we meet with open spaces in the centre of a section, which are lined with mucous membrane carrying on its surface (Fig. 8) ciliated epithelium and containing mucous glands. The cause of the presence of these spaces in the centre of the neoplasm is uncertain, but they may be accounted for by a coalescence of two adjacent polypi surrounding in their union a portion of still healthy nasal mucous membrane. We also sometimes find clots of blood coagulated within the meshes of the connective-tissue net-work, due to a rupture of some of the blood-channels, causing an extravasation of blood into the myxomatous tissue. These clots are, as a rule, found near the surface of the neoplasms, and the spontaneous epistaxis noticed in many cases of nasal polypi is probably due to a rupture of the surrounding membrane of the neoplasm, allowing the extravasated blood to ooze out into the nasal cavities.

These mucoid polypi are always multiple, occurring in large numbers, and varying in size in either or both anterior nasal cavities. Cohen¹ says that the masses after removal occupy a larger space than it would seem possible they could have occupied in the nose, and this may be accounted for by the fact that their not being subjected to pressure after removal allows them to swell to a much larger size by absorption of moisture from the atmosphere.

According to Mackenzie,² as well as to the observations of other rhinologists, mucoid polypi occur more frequently in men than in women, and the ages at which they have been observed range from twelve years up to seventy or eighty. But the largest number of cases have been observed between the ages of twenty and forty years. The youngest cases are recorded by Mason,³ who reports a case of a boy of twelve years, and by Mackenzie, that of a girl of sixteen. The latter author expresses his belief that all examples of cases of polypi of a younger age were cases of malignant fibromata, and not of mucoid polypi.

The various methods adopted at different times and by different surgeons for the removal of these neoplasms have been indicated in the

FIG. 8.



SECTION OF MUCOUS POLYPUS (Seiler).—1, epithelial layer; 2, infiltrated submucous layer; 3, mucous gland; 4, fibrous band; 5, venous sinus filled with blood; 6, myxomatous tissue; 7, transverse section of arteriole; 8, invagination of mucous membrane.

¹ Op. cit.

² Op. cit., p. 353.

³ Medical Society Proceedings, London, 1872-74, vol. i. p. 156 *et seq.*

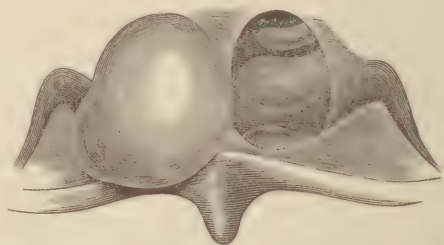
foregoing historical sketch, and are described in detail in other portions of this work. But, as the description of the etiology as well as the histology so clearly leads to a conclusion, I cannot resist the temptation of pointing out the one feature in the treatment which has for its object the prevention of a return of the neoplasms after removal. This feature is the destruction of the necrosed bone, the total removal of the spicules, and the persistent application of remedial agents to the denuded surfaces of the cleft middle turbinated bone, with a view to cause a reunion of the separated portions and a return to the normal adult form of this middle turbinated body.

Fibroids.—The second variety, which, however, fortunately, is not nearly as common as the mucoid variety, is the fibroid or fibrous polypus. It presents on rhinoscopy, both anterior and posterior, a mass within the nasal cavities of usually a glistening white or sometimes pinkish color, with blood-vessels of considerable size ramifying over its surface. To the touch, with a probe, or the finger, if near enough to the orifice to be thus reached, it feels hard and resisting. The mucus which exudes from the nostril or nasal pharynx is of a viscid, transparent nature, not usually stained as is the case in the mucoid variety. If the growth has existed for a considerable time, it may hang down into the naso-pharynx (Fig. 9), protrude from the nostril, and, as is sometimes the case, invade the adjacent cavities of the nose, such as the antrum, the sphenoidal cells, etc.

The subjective symptoms to which this form of polypus gives rise are somewhat different from those observed in the mucoid variety. Inasmuch as the mass is hard and unyielding and does not possess any hygroscopic properties, and furthermore as it occurs usually on one side only, and is of slow growth, all the symptoms come on gradually, one after the other. For this reason it is often impossible to determine with any degree of accuracy, from the clinical history, the commencement of the trouble. The first symptom, as a rule, is obstruction to breathing in the affected side of the nose, which is followed by a gradually increasing diminution of nasal resonance. Supra-orbital and dental neuralgia are the next symptoms, which, like the nasal obstruction, are persistent and progressive.

When the tumor has reached such a size that it completely fills the anterior nasal cavity, it exerts such an amount of pressure that it first causes a deviation of the cartilaginous plate of the septum, and, when that possibility of expansion has become exhausted, atrophy of the mucous membrane and necrosis of the lateral wall of the nasal chamber by press-

FIG. 9.



FIBROUS POLYPUS OF THE NOSE.—View of the growth as seen by posterior rhinoscopy (Mackenzie).

ure ensue, and the neoplasm makes its way into the adjacent cavities. If, on the other hand, the tumor expands backward, it gradually fills up the naso-pharyngeal cavity, depresses the soft palate, and finally makes its appearance in the fauces.

Both the mucoid and fibroid polypi, as well as the cystic variety, may be and often are mistaken for other nasal obstructions, such as deviation of the septum, middle hypertrophies, foreign bodies, and so forth, when rhinoscopy alone is used as a means of diagnosis. Therefore in all these cases the probe, as well as the finger, should be employed to test the consistency and mobility of the tumor or obstruction, thus adding the sense of touch to that of sight, and enabling the observer to arrive at a definite conclusion as to the nature of the obstruction.

Histologically, the fibroid variety differs greatly from the mucoid polypi, inasmuch as its structure consists of closely interwoven strands of white fibrous connective tissue, without any meshes, and without mere blood-channels, so that a solid mass of fibrous tissue is formed containing occasional mucous glands, and large ramifying blood-vessels, the walls of which are frequently canaliculated, preventing their contraction when the vessel is cut.

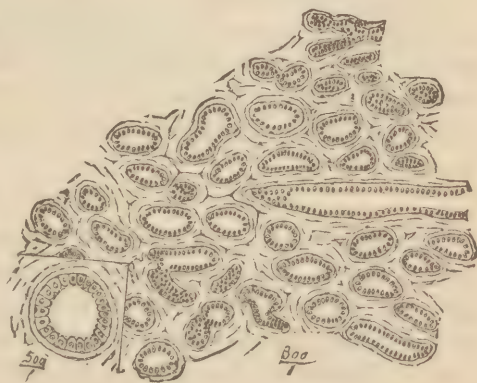
Schech¹ mentions the fact that in some cases the glands are so numerous as to present an appearance, under the microscope, of a section of an adenoma. (Fig. 10.) As a rule, the fibroid polypus springs from the connective tissue of periosteum of the bony plate of the septum, and is attached to its bed by a pedicle of considerable thickness.

Zuckerkandl² quotes fourteen cases in which the neoplasms had their origin on the edge of the semilunar hiatus, one case from the frontal bone, one from the sphenoid bone, and one from the ethmoid bone.

Of course, as Mackenzie³ says, the histological structure, the thickness of the pedicle, and

the firm attachment to the bed preclude the possibility of a spontaneous expulsion of a fibroid polypus; yet at the same time we find in many cases the neoplasm to be lobulated, and a localized constriction of the neck of one of these lobules may cause a sloughing off of one of these buds, which then may be blown out, and such cases have been recorded as instances of a spontaneous expulsion of fibroid polypi.

FIG. 10.



Tubular adenoma (Gross).

¹ Op. cit.

² Op. cit., pp. 64-84.

³ Op. cit., pp. 362, 363.

The prognosis is, of course, a bad one if the tumor is not removed early, because of its persistent growth and the already mentioned destruction of the parts with which it is in contact, leading to necrosis of the bones and consequent septicæmia, as well as chronic meningitis. The external contour of the nose itself is also considerably changed by this pressure, and if the tumor has invaded the antrum the cheek-bone is bulged outward, and the pressure upon the floor of the orbit causes also a bulging of the eyeball.

Cystic Polypi.—The third variety of nasal polypi is the so-called cystic variety, which, like the fibroid, is single, usually on one side only, but may occur together with the mucoid variety. The symptoms to which it gives rise are the same as those caused by the mucoid variety, and need not be further detailed. It is comparatively rare, the first case having been recorded by the author¹ but a few years ago, and since then some twenty or thirty cases have been recorded in the current medical literature. This neoplasm is nothing more than a delicate membranous sac covered with the epithelium found in the nasal cavities and filled with a straw-colored, sometimes sanguineous, serous fluid, which escapes when the membrane is pricked, and sometimes spontaneously. But the sac rapidly fills again, and the relief from the obstruction to the nasal respiration is of short duration.

It is somewhat difficult to understand the etiology of these cysts, but they are probably merely retention cysts due to the obstruction of one of the serous glands of the nasal mucous membrane. Their usual situation is at the posterior portion of the lower edge of the middle turbinated bones, and their size is generally small, but they may assume such proportions that they make their appearance, like the fibroid variety, at the anterior nasal orifices, or in the naso-pharynx. As they are attached by a narrow pedicle, their removal with the cold snare is a comparatively simple and easy procedure.

PAPILLOMATA.

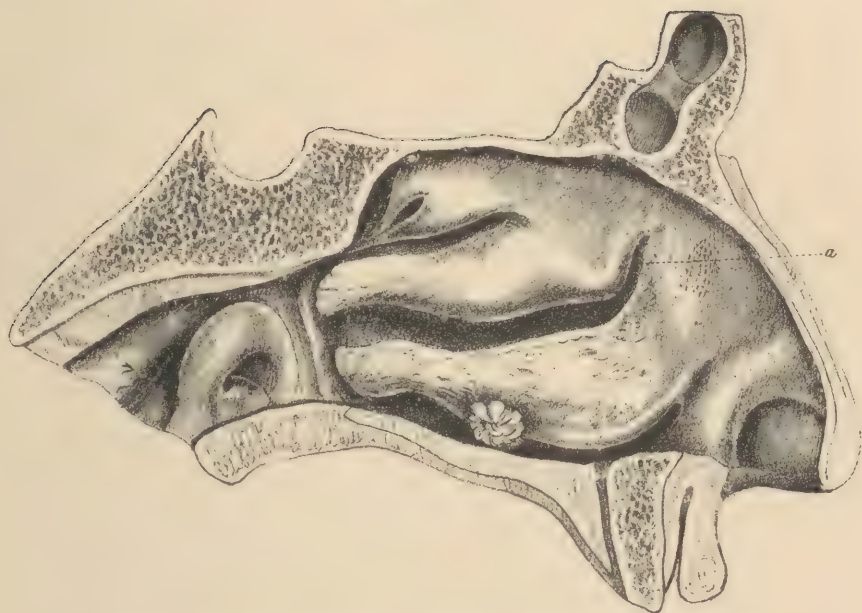
The next form of benign growths formed in the nasal cavities, springing as they do from the mucous membrane, are the papillomata, or warty growths. When we consider the histological structure of these growths, as well as of the mucous membrane of the nose, it seems but natural that this class of benign neoplasms must be quite rare, and the reports of the different observers must be taken *cum grano salis*; because in most instances these neoplasms, even after removal, were not subjected to microscopical examination, so that, no doubt, many of the reported growths were not papillomata, but growths resembling them in outward appearance only.

Hopmann² met with fourteen cases in one hundred nasal growths, and describes two varieties,—viz., the *epithelial* or *benign cauliflower excrescence*, and the *soft papilloma*. Among those removed by Hopmann was

¹ Archives of Laryngology, 1882.

² Virchow's Archiv, Bd. xciii., 1883.

FIG. 11.



Left nasal cavity with a papilloma on the inferior turbinated body (Zuckerkindl).

one four centimetres long; and in several other cases the neoplasms were multiple.

Mackenzie¹ reports only five cases of undoubted intra-nasal papillomata, and in four of these polypi were present at the same time. Zuckerkandl² reports only one case. (Fig. 11.) Schaeffer³ reports twenty papillomata out of one hundred and eighty-two nasal growths, and Bosworth⁴ only one in two hundred.

Mackenzie gives as the site in his five cases the mucous membrane covering the lower and anterior portion of the septum; in Zuckerkandl's case the tumor was found on the lower turbinated bone, and in Hopmann's cases the neoplasms were also found springing from the lower border of the lower turbinated bone.

The cause of the growth of this variety of neoplasms is, of course, somewhat doubtful, but as papillomata of the mucous membrane in other portions of the body are, as a rule, due to localized irritation or inflammation, we by analogy must assign the same cause to intra-nasal papillomata, from whatever cause such localized inflammation may come. And the fact that the most frequent position of these neoplasms was found to be the lower and anterior portion of the septum and of the lower turbinated bone, scratching with the finger-nail to remove small scabs, or the introduction of the twisted corner of a handkerchief into the nostril for a similar purpose, which is so frequently done by patients, may have been the cause of the localized inflammation of the parts.

ERECTILE TUMORS.

Erectile tumors, or angiomas, are extremely rare, and the only cases recorded are by Verneuil,⁵ Wagner,⁶ Steinbrügge,⁷ Seiler,⁸ Richet,⁹ Roe,¹⁰ Jarvis,¹¹ Vanderpoel,¹² and Burckhardt.¹³ Roe, in a comprehensive essay on this rare form of intra-nasal neoplasm, also mentions cases reported by Nélaton,¹⁴ Huguier,¹⁵ Panas,¹⁶ Guyon,¹⁷ Dumenil,¹⁸ a second case by Richet,¹⁹ and

¹ Op. cit., vol. ii. p. 377.

² Op. cit., p. 70.

³ Deutsche Medicinische Wochenschrift, 1882, No. 3.

⁴ The Nose and Naso-Pharynx, New York, 1889.

⁵ Annales des Maladies de l'Oreille, vol. i. p. 169.

⁶ Diseases of the Nose, New York, 1884, pp. 149, 150.

⁷ Zeitschrift für Ohrenheilkunde, vol. viii. p. 110.

⁸ American Specialist, Philadelphia, 1881, vol. ii. p. 7.

⁹ Cited by Debie, Thèse de Paris, No. 5, 1882.

¹⁰ Transactions of the American Laryngological Association, 1885, p. 94.

¹¹ International Journal of Antiseptics, vol. i. p. 1.

¹² Cited by Jarvis, loc. cit.

¹³ Bericht über die Chirurgische Abtheilung des Ludwigsspitals, Charlottenhilfe, 1884-85.

¹⁴ Cited by Bœuf, Thèse de Paris, No. 69, 1857, pp. 21, 25.

¹⁵ Bulletin de la Société de Chirurgie de Paris, 2e sér., vol. i. p. 7.

¹⁶ Bulletin de la Société Anatomique de Paris, 1872, vol. xlvii. p. 435.

¹⁷ Bulletin de la Société de Chirurgie de Paris, 3e sér., vol. ii. p. 356.

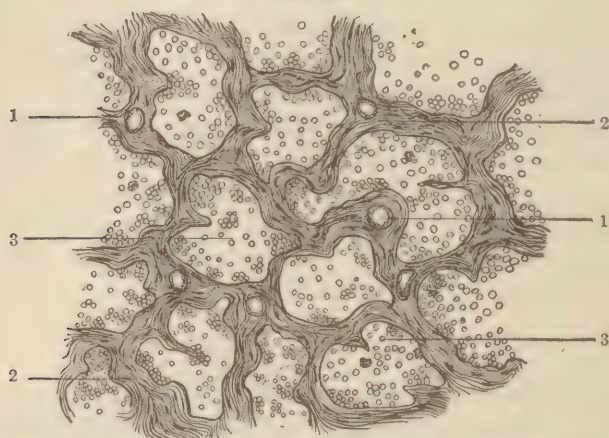
¹⁸ Ibid., p. 389.

¹⁹ Loc. cit.

one by Delavan.¹ But a careful examination of the clinical features of all these cases as reported leaves us but ten in all which were undoubtedly angiomata, and from which number our knowledge of this rare form of intra-nasal neoplasm is derived.

They are round, dark, sessile tumors, with a regular smooth surface, growing to the size of a cherry-stone, and are seen to pulsate synchronously with the heart. The only clinical difference between a tumor of this kind and an hypertrophy of the turbinated tissue is this pulsation, and histologically the difference consists in the fact that the meshes of the erectile tissue are in direct communication with one of the larger arterial branches, and are therefore not venous sinuses, such as we find in the turbinated tissue. (Fig. 12.) This fact is of importance in the choice of the method for the

FIG. 12.



SECTION OF ANGIOMA, $\times 300$.—1, 1, arterioles; 2, 2, connective-tissue strands, forming the meshes; 3, 3, sinuses filled with blood.

removal of such a tumor, as the hemorrhage must necessarily be vastly greater after the removal of an erectile tumor than is the case after removal of an hypertrophy.

CHONDROMATA AND OSTEOMATA.

Chondromata as well as osteomata of the nose are of very rare occurrence, and although they both spring from the same structures, and, pathologically considered, are very closely related to each other, we must clinically consider them under separate heads, because of the difference in consistency and the difference in the rapidity of their growth. The chondromata or cartilaginous tumors are, as already mentioned, extremely rare, and the first case reported was one occurring in the practice of Erichsen.² Bryant³

¹ Archives of Laryngology, vol. iii. p. 174.

² Lancet, 1864, vol. ii. p. 152.

³ Ibid., 1867, vol. ii. p. 225.

mentions two cases, and Ure¹ and Durham² are reported in Holmes's Surgery as recording each one case. Richet,³ Heurteaux,⁴ and Verneuil⁵ also reported cases later on.

Mackenzie⁶ states that these cartilaginous tumors occur at an age near puberty, when cell-development is most active, and also makes mention of the facts that in all the cases described the growth sprang from the cartilaginous plate of the septum, and that it is more common in the male than in the female.

The clinical features of these neoplasms very closely resemble those noticed in cases of fibroid polypi, and the differential diagnosis between a chondroma and a fibroid is frequently only possible by carefully noticing the difference in the elasticity and mobility of the two tumors. While the fibroid polypus, although hard and resisting to the pressure of the point of the probe, gives slightly, owing to its pedunculated attachment, the chondroma, being sessile, will not yield, and a peculiar gritty feel is imparted to the fingers holding the probe when the point of the latter is gently passed over the surface of the tumor.

Another difference in the clinical features of the two is that, owing to the immobility of the chondroma, the discharge which oozes from the nostrils is generally fetid. This fetor is produced by decomposition of the mucus, owing to its retention. The external appearance on inspection with the rhinoscope shows a glistening white or pinkish tumor, with blood-vessels very much like the picture presented by a fibroid polypus. But the surface of the growth is not smooth and rounded, and resembles rather the pock-marks of a patient's cheek who has recovered from a severe attack of small-pox.

The histological features are those common to all chondromata,—viz., a solid mass of hyaline cartilage, which sometimes is seen to undergo cystic degeneration in the centre; or calcareous nodules may be found here and there, and finally centres of ossification may have started in various portions of the growth, more or less numerous according to the length of time it has existed. This mass of cartilage is surrounded by a thick sheath of white fibrous tissue, which in turn is covered by a thin mucous membrane devoid of glands.

Like all other cartilaginous growths, the mass of the tumor is nourished by loops of capillaries dipping into the cartilage from the perichondrium. No cause can be assigned for these excrescences. All authorities agree that the prognosis is favorable if the proper method for the early removal of such neoplasms is employed.

¹ Holmes's System of Surgery, London, 1870, 2d ed., iv. 319.

² Ibid.

³ Casabianca, Des Affections de la Cloison des Fosses nasales, Paris, 1876, p. 59.

⁴ Bulletin de la Société de Chirurgie, November 7, 1877.

⁵ Quoted by Spillmann, Dictionnaire Encyclopédique des Sciences Médicales, xiii. 184.

⁶ Op. cit., p. 379.

Osteomata, or osseous tumors, like cartilaginous tumors, are extremely rare. Very doubtful cases have been reported by ancient writers; but Follin¹ seems to be the first one who gives a good description and makes a distinct differential diagnosis between osteomata and exostoses. These tumors do not spring from the osseous tissues of the nose, but are attached by a more or less slender pedicle to the mucous membrane of either the septum or the turbinated bodies. Clinically they present a smooth pinkish surface which may in places be eroded or ulcerated, which ulcers or erosions are then surrounded by areolas of dark and even purplish color, and, if of long standing, exfoliation of spicules of necrosed bone, together with the characteristic odor of decaying bone, may be noticed.

As is the case with fibroid polypi and chondromata, so also does the slow but persistent growth of the hard, unyielding bony mass produce deflection of the septum, and erosion of the walls of the nasal cavities, by pressure, and consequent distortion of the nose and disfigurement of the face. The pressure being by an absolutely unyielding substance, the early symptoms, besides occlusion of the affected side, are first itching, then sharp, lancinating pains of the face and head, and later anæsthesia, and even paralysis, when the tumor has destroyed the nerves as well as the blood-vessels supplying that part of the face. To the touch of the probe it feels hard and unyielding, and the sharpest needle cannot penetrate into its substance, as in the case of exostoses, nor will it break off particles of gritty substance, as is the case with rhinoliths.

Histologically two varieties of osteomata are recognized, the eburnized or solid form, and the cancellated variety, which latter usually presents a hollow space in the centre. The microscopical structure of these two varieties is identically the same as we see it in the two varieties of bone structure in the adult skeleton. It may happen that a bony tumor of the nasal cavity is covered with calcareous accretion, when the differential diagnosis between it and the rhinolith becomes almost impossible,—except that a rhinolith rarely, if ever, causes the neuralgic pain, or the erosion of the walls of the nasal cavities. The removal, of course, of these tumors, which may vary in size from that of a cherry-stone to that of a hen's egg, can usually be accomplished through the natural openings by first severing the pedicle and then delivering the growth with forceps, either through the post-nasal cavity, or, if not too large, through the nostrils. The origin, Mackenzie² suggests, might be from a spicule of bone extending either from the bony plate of the septum or from the turbinated bones, which spicule becomes broken or absorbed, leaving the tumor attached only to the mucous membrane. This explanation would make the neoplasm nothing more than a detached exostosis; but this, of course, is merely theory, and any attempt to explain the presence of these extremely rare growths would be futile.

¹ *Traité Élémentaire de Pathologie externe*, Paris, 1877, tom. iii. p. 839 *et seq.*

² *Op. cit.*, p. 883.

MALIGNANT NEOPLASMS.

Malignant tumors in the nasal cavity are mentioned by ancient medical writers and by authors of the Middle Ages, but the differential diagnosis, owing to the absence of pathological data, renders many of the cases doubtful. The later records, however, show that malignant tumors of the nose are not of common occurrence; also that if they do occur they are usually primary, and that the sarcomata are much more common than carcinomata and epitheliomata.

Thus, Fayrer,¹ Viennois,² Mason,³ Grünfeldt,⁴ Duplay,⁵ Hopmann,⁶ and others have published cases of sarcomata in the nose, and Verneuil⁷ and Péan⁸ mention each one case of carcinoma of the epitheliomatous type. Duplay⁹ reports a case of encephaloid and Neumann¹⁰ one of medullary carcinoma.

From this review of the literature it would seem that the remarks made in regard to the peculiar histology of the nasal cavities and of the nasal mucous membrane are again verified in the case of malignant tumors, as they were in the case of non-malignant intra-nasal neoplasms,—viz., that the epithelial type of tumor would presumably be much less common than the connective-tissue type. The malignant tumors usually spring from the septum, although instances have been reported in which they had their origin from the turbinated bones and the floor of the nasal cavities. Like the fibroid polypi, they are generally on one side, and single. They are attached by a broad base, are soft to the touch, bleed readily, and at an advanced stage of their growth are prone to ulcerate. Their color varies from a light pink, through the different shades of red, to purple, and even black, if of the melanotic variety.

The first appearance—which is, however, but rarely noticed—is that of a small pimple or flattened elevation of the mucous membrane. They grow more or less rapidly, and may assume enormous proportions. The clinical features to which they give rise are the same that we have noticed in the description of the symptoms produced by the fibroid polypi, with the exception that the discharge is of a greenish color, fetid, but without the characteristic odor of necrosed bone and the frequency of epistaxis.

¹ Medical Times, July 4, 1868.

² Lyon Médical, 1872, No. 18.

³ Medical Times, May 22, 1875.

⁴ Montpellier Médical, October and December, 1876.

⁵ Traité élém. de Pathologie externe, Paris, 1877, tom. iii. p. 846.

⁶ Virchow's Archiv, Bd. xciii., 1883.

⁷ Bonheben, De l'Extirpation de la Glande et des Ganglions sous-maxillaires, Thèse de Paris, 1873.

⁸ Quoted by Casabianca, Des Affections de la Cloison des Fosses nasales, Paris, 1876, p. 67 *et seq.*

⁹ Op. cit., t. iii. p. 788.

¹⁰ Oesterreich. Zeitschr. f. praktische Heilkunde, 1858, iv. 17.

As in other portions of the body, malignant tumors of the nose give rise to the peculiar, intermittent, lancinating pain so pathognomonic of cancer. In the later stages the glands of the neck become enlarged and hard, and metastasis may take place in other parts of the body. Cachexia soon ensues, and death supervenes usually within eighteen months from the time that the first symptom was noticed.

The prognosis, of course, is extremely bad,—in fact, hopeless,—and surgical interference, unless early instituted, or when absolutely necessary for the comfort of the patient, is not indicated, as experience has proved that these neoplasms grow much more rapidly and cachexia sets in much earlier after attempts at removal of the growth.

The differential diagnosis should not be difficult when the clinical history of the case, as well as the peculiarities of the neoplasm, are taken into consideration. For only osteomata, foreign bodies, and rhinoliths might be mistaken for cancerous growths; and the differential diagnosis in these cases is easily determined by the touch of the probe.

The origin or cause is as doubtful and uncertain as it is with cancer in other parts of the body; and the assumption held by some that syphilitic ulceration should assume a cancerous form and produce either sarcoma or carcinoma is not substantiated by clinical experience. The only case in which there is some reason to believe that a medullary carcinoma was caused by syphilitic ulceration is that reported by Neumann;¹ and even in that instance it is more likely that the cancer developed in the cicatricial tissue left after the ulcer had healed than that it should have been caused by the ulceration itself. It is just as unlikely that sarcomata should develop from fibroid or mucoid polypi, or carcinomata from warty growths, because histologically it does not seem possible that an adult tissue, such as fibrous connective tissue, should return to the embryonic type of connective tissue, the spindle- and round cell, or that the full-grown, well-nourished, and hardened adult epithelial cell should assume the characteristics of its embryonic prototype.

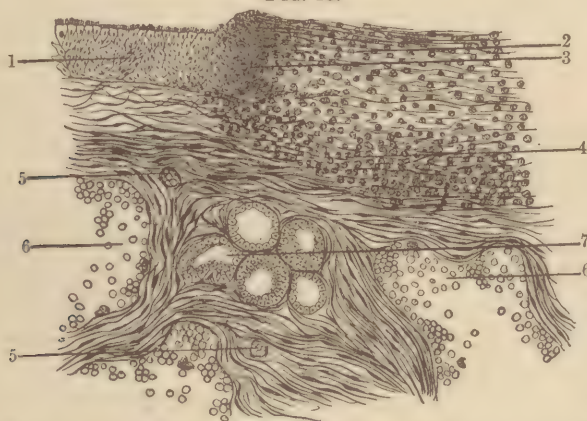
SYPHILIS.

The neoplasms proper having been discussed in the foregoing pages, it remains now to consider the diseases of the nasal cavities which give rise to tumors and obstructions interfering with the proper normal physiological functions of the nasal organ. Syphilis, standing as it does on the borderline, by the production of gummatous tumors, which, like tubercles, may be looked upon as neoplasms, is the disease which is perhaps more common, more frequently observed, and more difficult to diagnose than any other, and for these reasons forms an apt connecting link between true neoplasms and mechanical obstructions of the nasal chambers not due to a localized neoplastic cell-growth.

¹ Op cit., p. 17.

Syphilis of the nose, according to Mackenzie,¹ is spoken of by the earliest Chinese medical writer, the emperor Hoang-Ty,² who described syphilitic disease of the nasal cavities twenty-six hundred years before Christ. Many of the later writers of antiquity, such as Hippocrates³ and others, mention nasal stenosis due to syphilitic infection, and the standard as well as current medical literature of modern times is replete with accounts of cases in which tumors, swellings, and other obstructions of the nasal cavities, due to the specific virus, were observed. Inasmuch as the primary lesion of syphilis is extremely rare in the nose, and, like the so-called secondary lesions,—viz., the mucous patches and shallow ulcers (Fig. 13),

FIG. 13.



SYPHILITIC ULCER OF NASAL MUCOUS MEMBRANE, SLIGHTLY DIAGRAMMATIC, $\times 500$.—1, epithelium; 2, pus of ulcer; 3, cloudy epithelium melting into pus; 4, pus invading healthy tissue; 5, 5, capillaries gorged with blood; 6, 6, venous sinuses; 7, racemose gland.

—do not give rise to any obstruction which is noticeable, it is only the gummatous tumor with which we have to deal.

Gummata are usually seen on the cartilaginous and bony portion of the septum,—rarely on the turbinated bodies,—and on the floor of the nose. If in the latter situations they are usually unilateral, while if situated on the septum, and particularly if on the cartilaginous portion, they are generally found to be bilateral. They give rise to the subjective symptoms of nasal obstruction, accompanied by a serous discharge, loss of sense of smell, and pain in the cheek, eye, or forehead, which has the peculiarity of being most severe at night and very much ameliorated or entirely absent during the waking hours. When the tumor has existed for some time and ulceration has set in, the discharge becomes thickened, muco-purulent, and sanguineous, and a slight fetor is perceived.

On inspection with the rhinoscope, a sessile tumor is seen to project either from the wall of the septum or from the turbinated body, or, in rare

¹ Op. cit., p. 390.

² See Fabry, *La Médecine chez les Chinois*, Paris, 1863, p. 260 *et seq.*

³ Quoted by Mackenzie, op. cit., p. 390.

instances, from the floor of the nose, into the lumen of the nasal chamber. Its surface is smooth, and usually considerably paler in color than the rest of the mucous membrane, although in some cases it may be deep red, or even purplish, in hue. To the touch of the probe it feels immovable, hard, and yet elastic; although its surface cannot be indented by pressure. The histology of these nasal gummatous growths has been particularly studied by Saenger,¹ and perhaps most graphically described by Bosworth,² who says,—

“The essential pathological lesion which constitutes a gummatous deposit is an infiltration of the mucous membrane with small round cells, or inflammatory corpuscles, which invade not only the epithelial layer, but also the mucosa proper and the deep layers of the membrane or periosteum, and even the bone-tissue itself. . . .

“The membrane is crowded, as it were, with these small round cells, which so far encroach upon the periglandular structures as to obliterate the glands, probably by pressure, thus resulting in their destruction and the exfoliation of their lining epithelium. In addition to this, the same process invades the vascular structures of the membrane, more especially the nutrient arteries, giving rise to an infiltration of the arterial coats, and particularly the inner, by which their calibre is markedly diminished, and finally completely obliterated, partly, perhaps, as the result of pressure from without, but in the main as the result of a genuine endarteritis obliterans which is set up by their presence.

“According to Saenger,³ we occasionally find in the deep layers of the membrane, in addition to the small round-cell infiltration, a certain number of spindle-cells deposited in or near the periosteal layer. Saenger further states that as the result of the obliteration of the arteries we have a damming back of the blood, which may give rise to a hyperæmic condition of the tissues beyond, and that this is followed by localized extravasations of blood, and, as an occasional ultimate result, small cyst-formations.”

This obstruction of the nutrient vessels, as it gradually proceeds from the centre to the periphery of the gummatous tumor, deprives the quasinoplasm of its nourishment, the cells undergo the usual retrograde metamorphosis, due to want of nutrition, and an ulcer is formed, beginning in the centre and extending toward the periphery of the tumor, and if the ulcerative process is not arrested it will transgress the limits of the localized infiltration and invade the surrounding healthy tissue, whether it be mucous membrane, cartilage, or bone. But, as Bosworth⁴ observes, the syphilitic ulcer due to the breaking down of a gummatous deposit seems to respect anatomical limits, so that we never see an ulcer of this kind extend either into the vestibule or into the pharynx proper; although, as fre-

¹ Journal de Méd. Prat. et Pharm., 1858-59, vol. xxvi. p. 425.

² Op. cit., pp. 343-44.

³ Loc. cit., p. 425.

⁴ Op. cit., p. 344.

quently happens, all the bones, including the septum and turbinated bodies, may have been destroyed.

Unlike the gumma in the pharynx or soft palate, or even in the oral cavity, which ulcerates within a few days of its appearance, the gumma in the nasal cavity frequently remains for weeks and even months; and the author recalls a case in his own practice in which the clinical history clearly indicated bilateral gummatous deposits of the nasal septum to have existed a year, without showing any signs of breaking down, and giving rise only to the usual subjective symptoms of obstruction, coryza, and nocturnal pains. This peculiarity may be accounted for by the fact that the gummatous growth in the nose is protected from irritation first by the mucus covering its surface, and secondly by the absence of friction or pressure upon its surface, to which the gummata in the oral and pharyngeal cavities are continually subjected.

Mackenzie¹ speaks of condylomata as having been observed within the nasal cavities, but it is doubtful whether they were really intra-nasal, and it is more likely that they sprang from the skin of the vestibule.

Gummatous tumors of the nasal cavities may be mistaken for deviation of the septum, or septal abscess, or hypertrophy of the turbinated tissue; but the absence of a depression on the opposite side of the septum, as well as the peculiar elasticity to the touch of the probe, will exclude deviation of the septum. The absence of fluctuation, and the usual history of the long-continued existence of the nasal obstruction, prevent mistaking the tumor for a septal abscess. The same difference exists in regard to hypertrophy of the turbinated tissue, together with the most important symptom,—viz., nocturnal pain, which is never absent in a gummatous tumor of the nose.

It may not be considered good surgery to remove a gummatous deposit by surgical means, yet, when a gummatous tumor encroaches upon the lumen of the nasal chambers to such an extent as to cause stenosis, and the patient's general health has been so undermined by loss of sleep, owing to the nocturnal pains, Volkmann's method of scraping out the deposit will be found not only admissible, but also more satisfactory than the slow process of absorbing the deposit by internal medication. Another advantage of this procedure is, that the surrounding tissue will be saved from the extension of the ulcerative process should the gumma break down before the antisiphilitics have had time to cause its absorption.

TUBERCULOSIS.

Tubercular disease of the nasal mucous membrane is an exceedingly rare affection, and but twenty well-authenticated cases of intra-nasal tuberculosis are to be found, according to Bosworth,² in medical literature. Mackenzie³

¹ Op. cit., p. 396.

² Op. cit., p. 373.

³ Op. cit., p. 401.

acknowledges never to have met with a single case, and the author must admit the same. Very little, therefore, can be said about this disease except what can be gleaned from those few cases recorded.

The clinical features are a slight stenosis of the nasal chambers caused by a deposit of small tubercular nodes, varying in size from that of a bird-shot to that of a split pea, usually multiple, and in clusters, more commonly situated on the septum than in any other portion of the nasal mucous membrane; and coexisting with these nodes, or subsequent to them, shallow ulcers of an irregular rounded outline, without an aureola, of a grayish-pink color, lighter in the centre and near the periphery, so that it often becomes difficult to define clearly the edges of the ulcer. The secretion is of a grayish-white color, viscid in substance, and slightly opalescent, through the admixture of cell-débris, but in no way resembles pus (Bosworth).¹

Very little, if any, pain is caused by either the nodes or the ulcerations, and the latter are but slightly sensitive to the touch of the probe. The mucous membrane not involved in the morbid process is of the characteristic ashy grayish-pink color so frequently noticed in the mucous membrane of the larynx and pharynx when tubercular deposits are present in that portion of the upper respiratory tract.

In all the cases reported, tubercular disease of the lungs and other portions of the body either preceded or coexisted with the tubercular deposit in the nose, and they all ran a protracted course. There is only one exception, that reported by Demme,² which ran a rapid course, terminating fatally within six months; yet, this case having been observed in a small child, it is somewhat doubtful whether tubercular deposit really existed in the nose.

The microscopical examinations which were made by careful observers in a number of these cases showed the same picture and the same arrangement of histological elements that are so well known to pathologists as indicative of tubercle.

The prognosis, of course, is almost hopeless, and the question of surgical interference for the removal of either the nodes or the ulcerations is one not to be discussed here: still, it would seem useless, and even cruel, to scrape, cut, or burn when there is so little, if any, inconvenience to the patient from this local tubercular deposit, and when the general symptoms so far overshadow the local ones.

LUPUS.

Like tuberculosis, lupus is extremely rare, and the author has not met with a single case of lupus deposit or lupoid ulceration within the nasal cavities proper; although lupus of the soft palate, and even of the

¹ Op. cit., p. 374.

² Berliner Klinische Wochenschrift, 1883, No. 15, p. 217.

upper pharynx, is by no means uncommon. To judge from the recorded cases of undoubted intra-nasal lupus, which Bosworth¹ enumerates also as twenty, the subjective symptoms are mainly obstruction, muco-purulent discharge, fetor, and pain of a dull character extending into the cheek, eye, and forehead. On inspection, small, hard, but elastic tumors, multiple and arranged in clusters, are noticed more frequently on the septum than on the turbinated bodies or the floor of the nose, together with large masses of greenish or brownish dry scabs of hardened secretions, which when removed forcibly disclose a bleeding, ulcerated surface, with raised and indurated edges. These ulcerations are usually small and of an elongated oval shape at first, but have a tendency to run together and form large, irregular-shaped, crater-like excavations covered with a thick greenish-yellow pus, which easily becomes desiccated by the air-current, thus producing the masses of hardened scabs which are the chief cause of the nasal obstruction.

Lupus of the skin of other portions of the body generally either coexists with the lesions in the nose, or soon follows the appearance of the intra-nasal deposit. As in the case of syphilis and of tuberculosis, so also in lupus, the microscopical appearance of the deposit of lupus within the nose does not differ from the histological arrangement of cell-elements seen in lupoid deposits in other portions of the body.

The question of differential diagnosis of syphilis and tuberculosis was intentionally omitted in the description of those two affections, because the picture presented by a case of lupus of the nose had to be held up before the reader's mind before the differential diagnosis of these three local manifestations of general dyscrasias which are so much alike could be intelligently pointed out.

It is often difficult to make a differential diagnosis between the local manifestations of these three different diseases when they are seen in more accessible portions of the upper air-passages, such as the pharynx, the larynx, and the soft palate, and this difficulty must necessarily be increased by the restricted view obtainable when the deposits occur within the nasal chambers. But, if we bear in mind the peculiarities of the subjective as well as objective symptoms, the consistency of the neoplasms, the character of the secretion upon the ulcers, and the clinical history of the case, we can generally arrive at a definite conclusion as to the nature of the disease by exclusion, even without the aid of a microscopical examination of a portion of the new growths.

Thus, the syphilitic gumma is large, sessile, hard, yet elastic to the touch, and the mucous membrane covering it is of a reddish hue; while the tubercular node and the lupoid nodules are small rounded elevations, soft to the touch, multiple, and arranged in clusters. The mucous membrane in the tubercular deposit is always pale, while that in lupus appears

¹ Op. cit., p. 376.

of a normal hue. Nasal obstruction is produced within a short time and is of long duration when caused by a gumma. In tuberculosis there is little or no nasal obstruction, while in lupus the nasal stenosis, being due to the scabs covering the ulcerations, is intermittent, being relieved temporarily by the expulsion of these scabs. And, finally, when ulceration has set in, the syphilitic ulcer is of a rounded outline, with slightly-raised edges, with a zone of inflammation surrounding it, and covered with a yellowish-white, thick, and opaque layer of pus. The tubercular ulcer, on the other hand, is small, of irregular outline, without raised edges, no aureola around it, and covered with a thin grayish-white opalescent secretion: it does not easily bleed, and is not sensitive to the touch; while the ulcer of lupus is covered with the hardened secretion, forming scabs of a green or brown color, which when removed reveal a crater-like excavation, the edges of which are raised above the surface of the surrounding mucous membrane, without aureola, but bleeding easily, and touching which gives rise to sharp pain. Its outline when small is elongated, but when large and caused by the coalescence of a number of smaller ulcerations it becomes irregular in contour. The clinical history generally reveals the pre-existence or coexistence of other manifestations characteristic of the general systemic disease.

The prognosis of lupus in the nose seems to be the same as for lupus elsewhere, and the same may be said of the treatment.

HYPERPLASIAS.

Hyperplasias of the nasal chambers, although they are not, strictly speaking, neoplasms, yet, because they produce the same symptoms, present the same appearances upon inspection, and give rise to the same reflexes,

FIG. 14.

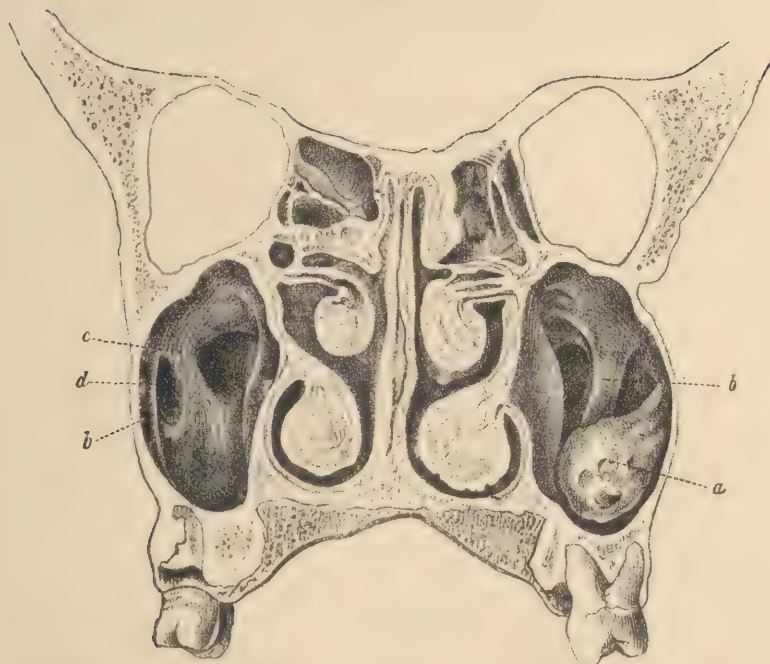


Dilated nostril, showing anterior hypertrophy (Seiler).

must be considered in this chapter,—the more so as they resemble so closely the true neoplasms that they are often mistaken for them, and their histological elements show a similar arrangement under the microscope. Within the last fifteen years, since the introduction of the modern improvements in rhinoscopy, these hyperplasias have received more and more attention, so that now the standard as well as current medical literature is so voluminous, and the individual writers

are so numerous, that references to individual observers would be entirely beyond the scope of this chapter, and therefore the subject will be discussed

FIG. 15.



TRANSVERSE SECTION OF FRAMEWORK OF SUPERIOR MAXILLA, ANTERIOR SEGMENT. IN THE LEFT ANTRUM OF HIGHMORE IS A LARGE POLYPUS (Zuckerkindl).—*a*, polypus; *b*, ridge of infra-orbital canal; *c*, infra-orbital depression; *d*, depression of cheek-bone.

FIG. 16.



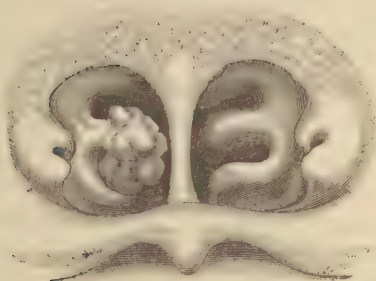
OUTER WALL OF LEFT NOSTRIL (Seiler).—1, superior turbinated bone; 2, middle turbinated bone, with posterior hypertrophy; 3, section of hypertrophied pharyngeal tonsil; 4, inferior turbinated bone; 5, orifice of Eustachian tube.

in an entirely general way, based upon personal experience as well as upon the knowledge acquired through the writings of others.

The first form of hyperplasias to be considered is that to which the name of hypertrophies has been applied. Two varieties of hypertrophies of the turbinated tissue are observed, which differ from each other chiefly in location, and but slightly in their clinical features, but not at all in their histological structure. These two varieties are the anterior and middle hypertrophies (Fig. 14), situated (Fig. 15) on the anterior aspects of the lower and middle turbinated bones, and the posterior hypertrophies (Fig. 16), which are found at the posterior ends of the lower and middle turbinated bones. (Fig. 17.)

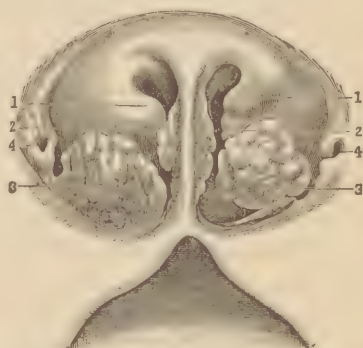
On inspection of the nasal chambers we notice rounded sessile eminences projecting into the nasal cavity, of the color of the ordinary nasal mucous membrane in most cases. Sometimes they appear lighter in color, due to the fact that the mucous membrane itself has become anæmic by pressure upon its capillaries. In the case of the posterior variety of hypertrophies the tumors can be seen only with the rhinoscope (Fig. 18), and present a

FIG. 17.



RHINOSCOPIC IMAGE FROM A CASE OF POSTERIOR HYPERTROPHY OF MIDDLE TURBINATED BONE (Seiler).

FIG. 18.



RHINOSCOPIC IMAGE IN A CASE OF CLEFT PALATE, WITH POSTERIOR HYPERTROPHY.—1, 1, middle turbinated bone; 2, 2, hypertrophic tissue on vomer; 3, 3, posterior hypertrophies on lower turbinated bone; 4, 4, opening of Eustachian tube.

raspberry-like surface of a grayish-white, reddish, or even purplish color, and, unlike the anterior variety, they are more or less pedunculated, projecting into the posterior nasal chamber.

The anterior hypertrophies when pressed upon with the probe can be indented, but immediately assume their rounded outline on removal of the pressure.

The subjective symptoms to which these hyperplasias give rise are chiefly nasal obstruction to a greater or less degree, according to their size and location, which obstruction comes on so gradually that the patient is often unconscious that nasal respiration is materially interfered with. In the recumbent position the hypertrophies become larger, and the patients

frequently notice that that side of the nose which is undermost in lying becomes stenosed, and opens again when the body is turned to the other side. The ingestion of hot food or hot drinks, as well as emotional excitement, also has a tendency to increase the bulk of the hypertrophies, and consequently increases the nasal obstruction. The normal secretion of the nose is greatly diminished, and particularly is this true of its watery or serous element: so that accumulations of thick, glairy mucus occur in the posterior nasal chamber, which form the chief source of annoyance to the patient.

In the case of anterior hypertrophies, particularly when situated on the lower turbinated bone, it is not uncommon to find a gradually-increasing indentation of the cartilaginous plate of the septum, and the consequent bulging on the opposite side amounting in many cases to deviation, and also do we find, not infrequently, below the point of impact of the hypertrophy against the wall of the septum, a projection of the cartilaginous septum.

When the hypertrophy is situated on the middle turbinated bone and presses against the bony portion of the septum, pains of a neuralgic character over the eyes, high up in the forehead, or in the nape of the neck are frequently complained of, and these pains or headaches, which may be of an intermittent character, are not infrequently accompanied by nausea, and even vomiting, thus closely resembling sick headache or migraine. In other cases this condition gives rise to paroxysms of sneezing, especially in the mornings, or whenever an increase in the bulk of the hypertrophy takes place, and in those cases in which the hypertrophy is situated on both sides of the nasal chambers and is so large as to close the upper portion of the chambers the sense of smell is greatly diminished or entirely lost. If the posterior hypertrophies are very large, they not infrequently prevent the introduction of air into the Eustachian tubes, by pressure upon the lateral walls of the posterior nasal cavity, and thus dulness of hearing and tinnitus are produced.

The pressure exerted by the hypertrophies upon the circulation within the nose, and the inability of the turbinated tissue to swell, and thus act as an overflow in cases of sudden capillary congestion of the skin of the nose and cheeks, give rise to the frequently-observed symptom of acne of the face and nose, particularly at the age of puberty, and in women during pregnancy, when the erectile tissues in other parts of the body are in a stage of greatest activity.

There is no doubt that these hypertrophies of the erectile tissue in the nose are produced by irritation and consequent congestion of the mucous membrane, by repeated and frequent attacks of acute coryza, or by the impact upon the mucous membrane of irritating dust floating in the atmosphere, or, finally, by irritating gases, insufficient oxygen, and nervous irritation. But it is impossible to say when the erectile tissue of the nose begins to be hypertrophied.

The histological structure of the anterior, middle, or posterior hypertrophies is merely a superabundance of the connective-tissue net-work of the ordinary erectile tissue (Fig. 19), together with an increase in the size of the venous sinuses, and a greater or less infiltration of inflammatory corpuscles into the connective-tissue net-work and the mucous membrane proper.

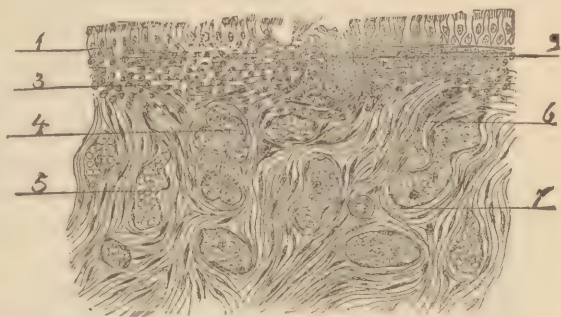
In regard to treatment a few words may not be out of place in this article calling attention to the fact that the anterior as well as middle hypertrophies are sessile, and as the connective-tissue strands are very much enlarged and thickened, and the venous sinuses of the erectile tissue distended with venous blood, little can be gained by the application of astringents, and surgical measures must be adopted for their removal. A very popular and eminently satisfactory method is cauterization with galvano-cautery; but it should be observed that unless the cautery knife is carried through the hypertrophied tissue down to the periosteum nothing is gained, because the small amount of tissue destroyed is near the surface, and the cicatrix following the healing of the burn does not tie down the bulging tissue as it will when adherent to the periosteum as a fixed point.

It is also well to remember that when the mucous membrane of the nose is in a state of acute or subacute inflammation, and particularly in the peculiar anæmic condition following the so-called grippe, the galvano-cautery does not give satisfactory results.

ECCHONDROSIS.

In cases of hypertrophic rhinitis we often notice projections from the cartilaginous plate of the septum, situated, as a rule, on the anterior and lower portion. They are seen on inspection of the anterior nasal chambers to be mostly unilateral, and but rarely bilateral, forming projections of various shapes and sizes covered with mucous membrane, which is sometimes excoriated on the highest point (Fig. 20), but otherwise of normal appearance. The shape may be a cone-like protuberance from the surface, or it may be like a ridge, running from below upward and backward in a slanting direction, or the most frequent shape may be that of an inverted shelf, sloping from below upward and presenting an almost straight surface running directly out from the wall of the septum and close to the floor of

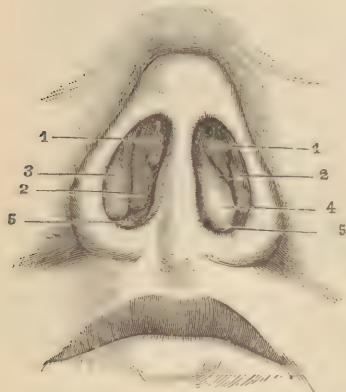
FIG. 19.



1, epithelial layer; 2, mucous follicle; 3, submucosa, showing inflammatory infiltration; 4, mucous glands; 5, venous sinuses filled with blood; 6, small branch of arteriole; 7, transverse section of arteriole.

the nose, leaving a space or tunnel through which frequently even a thin probe can be passed only with difficulty. Inasmuch as these ecchondroses are usually found in connection with anterior hypertrophies, they themselves, perhaps, do not give rise to any distinct symptoms, but as they

FIG. 20.



DILATED NOSTRILS SHOWING ECCHONDROSIS OF SEPTUM.—1, 1, middle turbinated bone; 2, 2, lower turbinated bone; 3, edge of vestibule; 4, shelf-like projection from septum; 5, 5, floor of nose.

project into the cavity of the nose, already encroached upon by the hypertrophied erectile tissue, they increase the stenosis. They also occasionally give lodgement to thickened secretion, which becoming dry forms small scabs tightly adhering to the mucous membrane and causing by their forcible dislodgement the excoriations above mentioned.

Histologically considered, they are nothing more than a localized hyperplasia of the cartilage cells of the septum, which may or may not undergo ossification. Their causation is undoubtedly due to localized congestion of the nutrient vessels of the cartilage, in most instances caused by the pressure of the hypertrophied turbinated tissue, and in not a few instances

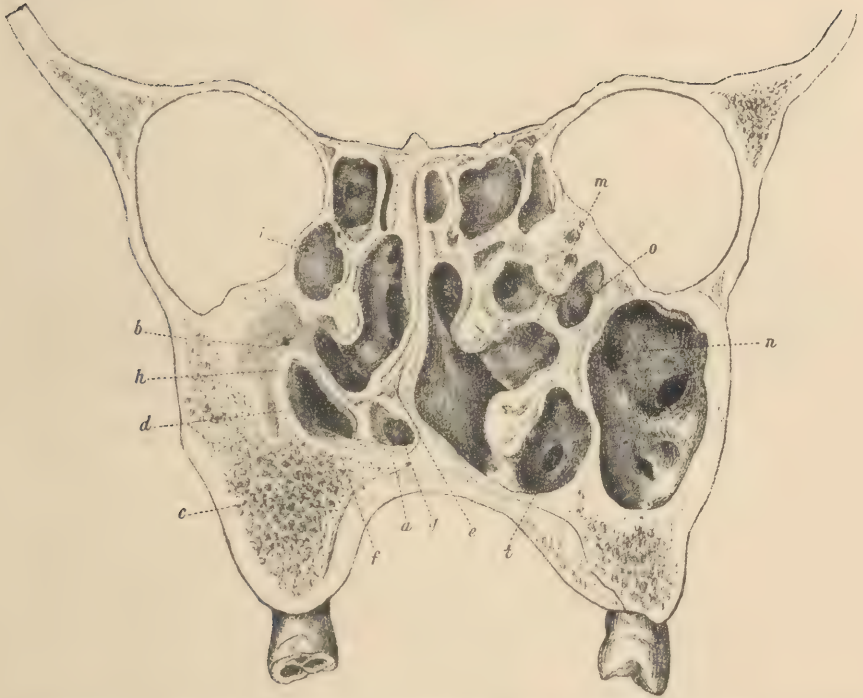
the outline of the anterior hypertrophy can be traced in the shape of the ecchondrosis. Still other localized irritations, such as foreign bodies, rhinoliths, etc., may cause this peculiar condition, and in one instance the growth of an ecchondrosis on the lower and anterior portion of the septum was carefully watched. In this case the source of irritation was a habit of the patient to introduce the little finger into the nostril and press its tip against the wall of the septum, without, however, scratching the mucous membrane with the nail: this gentle and intermittent pressure caused a teat-like ecchondrosis to grow in the course of a few months.

It is not likely that, on careful inspection of the anterior nares, either hypertrophies, both anterior and middle, or ecchondroses, could be mistaken for any other of the numerous neoplasms met with in the nose, and also, as in the case of anterior hypertrophies, local applications of astringents or other drugs cannot be expected to remedy the difficulty. Surgical measures alone are of any avail.

SYNECHIÆ.

Synechiæ, or bridges connecting the turbinated bodies with the wall of the septum, are not infrequently met with in hypertrophic rhinitis. They are either cartilaginous or bony, and but rarely membranous. They are covered with normal mucous membrane, and may be situated in any portion of the anterior nasal chambers, thus dividing the cavity into two portions. If they are situated low down in the respiratory tract (Fig. 21),

FIG. 21.



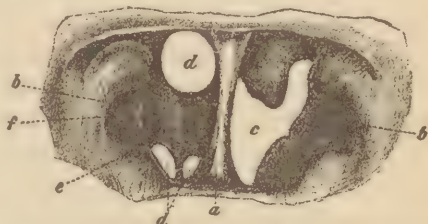
SYNECHIA IN LEFT NASAL CHAMBER.—*a*, asymmetrical lower nasal wall; *c*, spongy- and *b*, connective-tissue masses encroaching upon the cavity of the sinus; *d*, lower turbinate; *e*, hamular process of the septum; *f* and *g*, the lower nasal gallery divided by synechia between the lower turbinate and the nasal floor; *h*, upper part of the lower nasal gallery; *i*, synechia between the middle turbinate and the septum; *m*, middle turbinate adherent to outer nasal wall; *n*, ostium maxillare; *o*, cells of ethmoid bone; *t*, meatus of the lachrymal duct (Zuckerkindl).

they act as a dam or obstruction to the air-current, causing the thickened secretion to lodge behind them until it becomes putrefied and causes the symptom of ozaena together with that of nasal stenosis. The usual cause of these bridges is the simultaneous excoriation of the mucous membrane of both the hypertrophy and the septum at the point of contact, which favors agglutination, and later the projection of a mass of cartilage cells into the erectile tissue. This excoriation of the mucous membrane may be, and usually is, due to the friction of the two surfaces against each other in the act of respiration at a time when the anterior hypertrophy has not as yet caused complete stenosis.

They may, however, also be produced by surgical interference for the removal of nasal obstructions, when both the mucous membrane of the turbinated bodies and that of the septum opposite have been wounded.

Congenital synechia in the shape of a bony bridge across the posterior nares is sometimes met with, but is of exceedingly rare occurrence (Fig. 22). A differential diagnosis can always readily be made by the sense of touch in passing two probes, one above and the other below the obstruction, and in that way the thickness, the density, and the extent of the bridge can be easily determined. The only condition which might be mistaken for a synechia is an uncurling of the lower turbinated bone so that it projects straight across the nasal chamber and comes in contact with the wall of the septum,—a condition which is, however, extremely rare.

FIG. 22.



POSTERIOR VIEW OF CONGENITAL BONY OCCLUSION OF LEFT POSTERIOR NARIS.—*a*, septum; *b, b*, Eustachian tubes; *c*, normal posterior nasal opening; *d, d, d*, posterior nares divided into three openings; *e*, hamular process of the septum; *f*, inferior turbinated body.

EXOSTOSES.

Exostoses are bony projections from the bony framework of the nose, usually situated either on the floor of the nose near the margin of the vestibule or on the bony portion of the septum. When seen in the former position they spring from the superior maxillary bone, and are of extreme density; they appear as rounded eminences projecting from below upward into the nasal cavity, and are covered with pale mucous membrane, which is frequently excoriated, due to the removal of the dry scabs which find lodgement behind them by the finger-nail of the patient. If situated on the bony plate of the septum they are usually near the middle of the plate, and, like the ecchondroses, which they closely resemble, are of various sizes and shapes.

They are covered also with mucous membrane, but of normal color and appearance, and do not produce any particular symptoms by themselves.

It is probable that, like the ecchondroses, these bony excrescences are due to localized congestion of the periosteum, and the consequent hyperplasia of bone-corpuscles due to hypernutrition.

FOREIGN BODIES.

Foreign bodies are not infrequently met with in the nasal cavity, and according to their situation and the length of time during which they have remained within the nose they give rise to a group of symptoms which often closely resemble those produced by neoplasms. The different foreign bodies are introduced into the nasal cavities through the nostrils, usually by children and insane persons, or through the naso-pharynx, in the act of vomiting or choking, or, thirdly, through the external integument, and finally by growth and development, as in the case of maggots.

Of course the *first* class is the most common, and the instances met with by every physician are usually of so little import that in the general literature and the text-books of medicine the subject is treated very lightly. At the same time, the specialist meets with cases which are much more grave and present features which are not usually seen in those cases in which the foreign body has remained within the nasal cavity but a short time. The articles which have been found as foreign bodies are of various kinds, such as shoe-buttons, pieces of wood, small pebbles, beads, beans, peas, allspice, paper, cotton, etc. Usually they are seen to lodge in the lower and anterior portion of the nasal cavity immediately beyond the vestibule, but they may also be found farther back in the lower meatus, being carried thither by the air-current in forcible inspiration or "sniffing," or they may even lodge in the middle meatus or be wedged in between the middle turbinated bone and the septum. The immediate symptoms are nasal obstruction and sneezing, whereby the foreign body in a majority of cases is spontaneously expelled. If this expulsion does not occur, the contact of the foreign body with the mucous membrane gives rise to an acute inflammation, which in no way differs in its symptoms from the ordinary acute coryza, but it does not spontaneously resolve itself within a few days, and persists for weeks and even months, until finally the mucous membrane becomes tolerant to the presence of the foreign body, and only the ordinary symptoms of chronic hypertrophic rhinitis may supervene. In this way alone can we explain the possibility of a foreign body being retained within the nasal cavity for years, as in instances recorded by Renard,¹ Boyer,² Bosworth,³ Mackenzie,⁴ and others, and in an interesting paper written on the subject by Bron.⁵

Generally, however, a foreign body very speedily gives rise to an ulcerative process of the mucous membrane, with pain in the forehead and cheek,

¹ Journal de Médecine, t. xv. p. 525.

² Traité des Maladies Chirurgicales, Paris, 1846, t. v. p. 65.

³ Op. cit., p. 321 *et seq.*

⁴ Op. cit., p. 482 *et seq.*

⁵ Gazette Médicale de Lyon, 1867, No. 36.

paroxysms of sneezing, and yellow or sanguineous discharge, sometimes mixed with white, cheesy, flocculent masses, which Bosworth¹ believes to be cheesy degeneration of inspissated mucus and to be characteristic. The breath becomes extremely fetid, the sense of smell is lost, and the voice grows nasal. As the swelling of the mucous membrane extends to the other side of the nose and into the naso-pharynx, by obstruction of the orifices of the Eustachian tubes the hearing becomes affected. On inspection by aid of the proper instruments, the foreign body can usually not at first be seen, because it is covered with the muco-purulent discharge, and because the tumefaction of the turbinated tissue in front of the foreign body is so great as to obstruct the view.

Only after thorough cleansing with an alkaline wash in the form of a spray, and the introduction of a pledget of cotton saturated with a four-per-cent. solution of cocaine, for the purpose of reducing temporarily the swelling of the turbinated tissue, can the foreign body be seen and its nature and location determined. But then it is not always possible to make a correct diagnosis, even with the aid of the probe, because hard substances, such as shoe-buttons, pebbles, etc., are often encrusted with calcareous deposit and may then be mistaken for rhinoliths; while soft substances, more particularly seeds of plants, have become swollen and distorted, and may even sprout, so that they can easily be mistaken for polypi or malignant neoplasms.

Boyer² recites a curious case of a "haricot" bean which shot out ten or twelve roots and produced the appearance of a polypus, for which it was in fact mistaken. As a rule, a history is not obtainable, and it is difficult to determine with any degree of accuracy how long the foreign body has remained within the nose, because there is either an unwillingness on the part of the patient to confess to having introduced a foreign body, or, in the case of children, absolute ignorance or forgetfulness, and it is often amusing to hear the earnest protestations of a fond mother that her child was never out of her sight, and could not possibly have put anything up its nose without her knowing it. And still more amusing is it to see her dismay, and even anger, when she is confronted with the actual cause of the trouble, the foreign body.

The *second* class of foreign bodies which usually lodge in the posterior portion of the nasal cavity are, as a rule, composed of particles of food, and are thrown into the naso-pharyngeal cavity in the act of vomiting. Or they may be substances accidentally inhaled into the larynx and propelled into the nose by the spasmodic cough due to the irritation of the laryngeal mucous membrane, and this accident is favored by partial or complete paralysis of the soft palate. The irritation produced by the presence of the foreign body causes sneezing, and forcible expiration through

¹ Op. cit., p. 323.

² Op. cit., p. 66.

the nose, and if the body is small enough, as is the case when cherry-stones, pieces of bone, or similar substances have been vomited into the post-nasal cavity, they are likely to be forced into the anterior nasal chamber from behind, and find lodgement in the same localities in which we generally see foreign bodies introduced wilfully through the nostrils. In these instances the same symptoms and appearances of the mucous membrane are observed as in the former type.

On the other hand, when the foreign body thus introduced into the post-nasal cavity is too large to be propelled by the air-current into the anterior nasal chamber, it is not likely to remain very long in its abnormal position; although Lowndes¹ records a case in which a metal ring was removed from the post-nasal cavity of a child fifteen months old, which was too large to pass through the nostrils, and must, therefore, have been swallowed and thrown up. Another case occurred some years ago in Baltimore, in which an undigested raw oyster had been vomited into the naso-pharyngeal cavity and was mistaken for a fibroid polypus. Generally the "hawking" as well as the efforts of the patient to dislodge a foreign body by introducing the finger behind the velum are sufficient to remove the offending substance, which is then expectorated.

It sometimes, but rarely, happens that a tampon which had been introduced by the physician for the purpose of stopping epistaxis is wedged in so tightly that it is not dislodged together with the rest of the tampons, and may remain for a considerable length of time *in situ*. It becomes then discolored as well as covered by the secretions, and may very easily be mistaken for either a small fibroid polypus or a posterior hypertrophy.

A case of this kind came under the notice of the author not long since, and the symptoms produced by this foreign body were those of nasal obstruction and scanty thickened secretion, together with headache, such as we see in ordinary chronic hypertrophic rhinitis.

Bosworth² mentions a unique case of foreign body retained in the naso-pharyngeal cavity for many years. In this case he removed a deciduous tooth from the nasal cavity of a gentleman aged thirty-seven years, which had been the cause of a purulent catarrh for twenty-five years.

Sometimes it may happen that a foreign body is introduced into the nasal cavities, and retained there, through the skin or the bones of the face, or even through the alveolar process of the superior maxillary bone: thus, spent musket-balls, shells, lead-pencils, points of knives or daggers, and even tooth-picks and needles, have been found within the nasal cavity. Le-gouest³ reports a case of a carpenter who was stabbed by a man in the nose with a pencil, the broken end of which was subsequently removed through the nares.

In all these cases there is naturally an external wound or cicatrix which

¹ British Medical Journal, September, 1867, p. 206.

² Op. cit., p. 321.

³ Traité de Chirurgie d'Armée, Paris, 1863, p. 383.

marks the entrance and the method of entering of the foreign body into the nasal cavities ; but these instances are extremely rare, and more curious than instructive, particularly as the subjective symptoms do not differ from those produced by foreign bodies introduced either through the nostrils or through the posterior nares.

A still more curious accident is the introduction of the eggs of the ordinary house-fly into the nostrils in Southern climates. These eggs are deposited by the fly while the victim is asleep, and they develop with remarkable rapidity into maggots, which crawling upward into the nasal cavities give rise to the various symptoms already described, with the addition of formication, which is said to be so irritating that convulsions and death have occurred in a number of instances within a few hours after the development of the maggots. Some of the older writers mention cases in which earwigs, centipedes, and ascarides have been discovered as foreign bodies in the nose ; but no such accident is to be found in modern medical literature.

RHINOLITHS.

Rhinoliths, which are accumulations of the salts of the nasal secretion, are occasionally met with in the nasal cavities, and they act in a similar manner and give rise to the same symptoms as foreign bodies. They may be situated in any portion of the anterior nasal cavities, and some instances have been recorded in which they had penetrated into the soft tissues and were partly covered with mucous membrane. They are of various shapes and sizes, irregularly elongated, with a rough and often spiculated surface, varying in color from a light gray to brown, and even black. They are hard and brittle to the touch, and, when seen *in situ*, are covered by mucopurulent discharge or scabs of desiccated mucus, which must be removed by washing before a definite diagnosis can be made. It is not known definitely what gives rise to the accretion of the salts forming the rhinolith, and the theory that a foreign body is invariably the exciting cause around which as a nucleus the calcareous material is deposited in layers is not always borne out by fact.

Bosworth¹ suggests that those cases in which a calcareous deposit is in the shape of a lamella or cast, having on its inner aspect the shape of a projecting portion of the nasal tissues, such as the pendent portion of turbinated bone, or a deflection or ecchondrosis of the septum, may be due to a calcareous degeneration of the mucous membrane, as described by Virchow² and Kölliker.³

Instances are on record in which rhinoliths were found in both anterior nasal cavities, and in a number of other cases the calculus when broken showed a hollow centre. It is more probable that the nucleus is a dry scab of mucus, and the altered secretion in a case of atrophic rhinitis is

¹ Op. cit., p. 328.

² Cellular Pathologie, IV. Aufl., Berlin, p. 453 and note.

³ Gewebelehre: Geruchsorgan.

more likely to undergo calcareous change than is the superabundant secretion from the actively-inflamed mucous membrane irritated by a foreign body. The suggestion made that the calcareous deposit in the shape of a rhinolith is due to a gouty diathesis is not borne out by clinical observation, nor by an analysis of the recorded cases. A differential diagnosis, as already suggested, is easily made, because small portions of the surface can be broken off with the point of a needle, and this fact, together with the peculiar hard and metallic sound which is emitted when the calculus is tapped with the probe, at once distinguishes it from an osteoma, the only neoplasm for which it could possibly be mistaken.

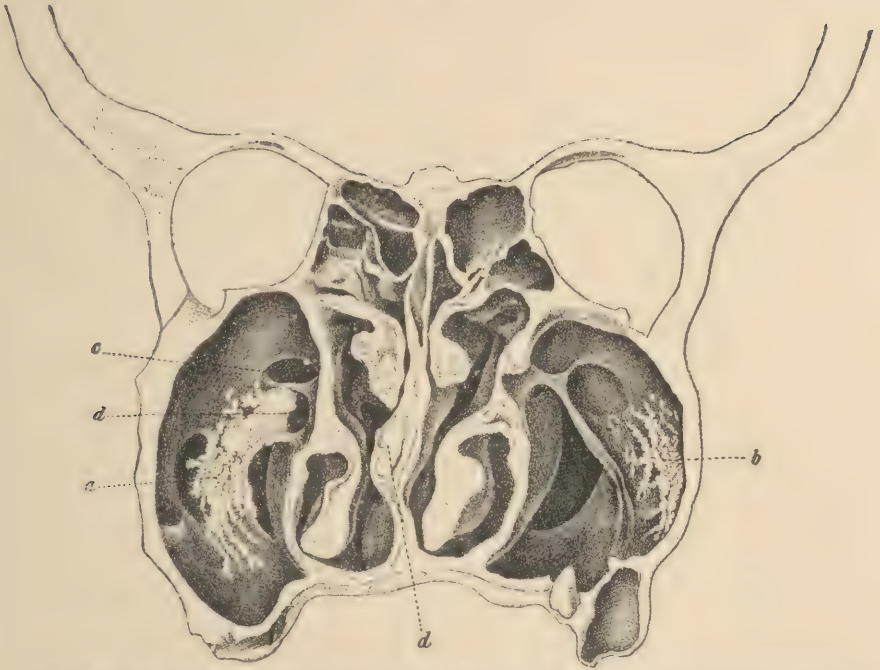
The literature on this subject does not date back very far, nor are the reports of cases very numerous, probably owing to the fact that most of them were published in various and, to the writer, often inaccessible medical journals of different countries. It is astonishing to what size these calculi will sometimes grow. The writer met with a case some time ago in which a rhinolith had obstructed the left nasal cavity for about ten years, giving rise to muco-purulent discharge, with occasional epistaxis, and a most horrible stench. At the suggestion of the patient's wife, he at last submitted to an operation under ether, and then it was discovered that the calcareous mass completely filled the lower portion of the left anterior nasal cavity, extending from the edge of the vestibule to the posterior edge of the vomer, three and a half inches in length, and in width, by actual measurement, it was three-quarters of an inch. Its thickness could not be ascertained, nor was it possible to determine its weight, because it was necessary to employ a lithotrite of considerable strength to break up the calcareous mass into small crumbs before it could be removed, and most of the pieces were lost in the copious hemorrhage. Only one portion was saved, and this was found to weigh forty-six grains when dry.

The accumulation of scabs of desiccated mucus in some cases of atrophic rhinitis sometimes forms a solid mass, filling up the channel, so that stenosis of the nasal chambers, with all its concomitant symptoms, is produced. These masses can readily be distinguished by inspection, by the sense of touch, and by the clinical history, from neoplasms, foreign bodies, or rhinoliths,—particularly because they are spontaneously expelled periodically, only to reform within a short space of time.

The writer has met with three instances of large pieces of necrosed bone lying loose in the nasal cavity, in which an ulcerative process had destroyed the bony walls as well as the septum, but had healed and left the detached pieces of bone to act as foreign bodies. In one case the portions of bone were so large that they had to be cut with bone-forceps before they could be removed, and in another case, owing to the fact that a dense cicatricial tissue had agglutinated the edge of the velum to the posterior wall of the pharynx, the pieces could be removed only with great difficulty through the nostrils.

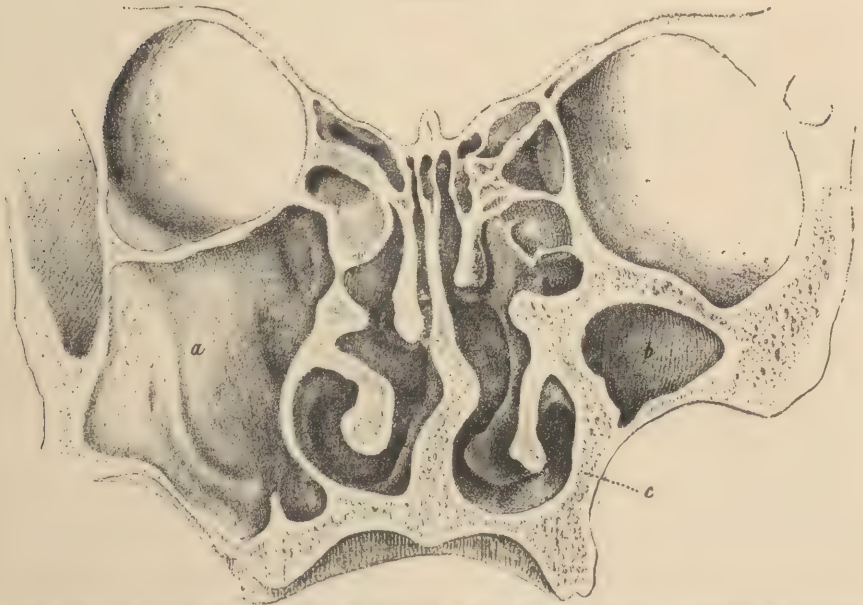
All these cases occurred in young girls, and no family history of syphilis

FIG. 23.



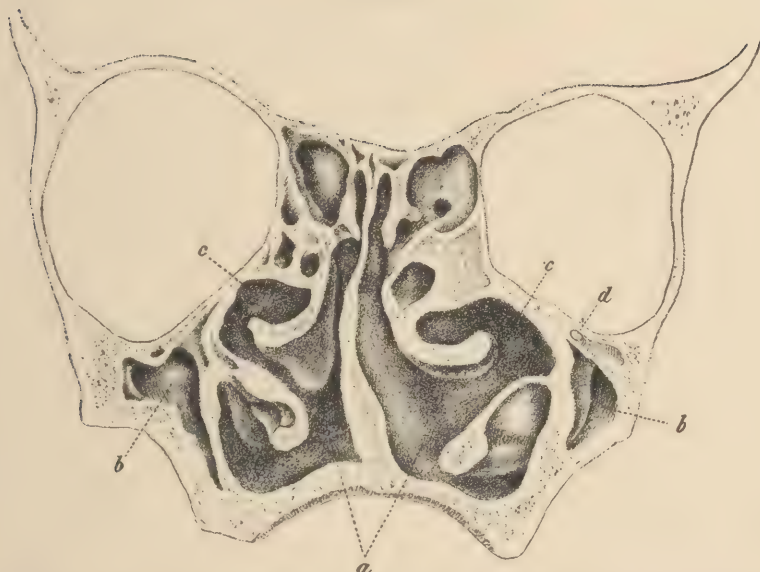
TRANSVERSE SECTION OF THE FRAMEWORK OF THE SUPERIOR MAXILLA, ANTERIOR SEGMENT (Zucker-kandl).—*a* and *b*, pus-filled glandular follicles in the mucous membrane of the sinus; *c*, infra-orbital depression; *d*, deviated septum.

FIG. 24.



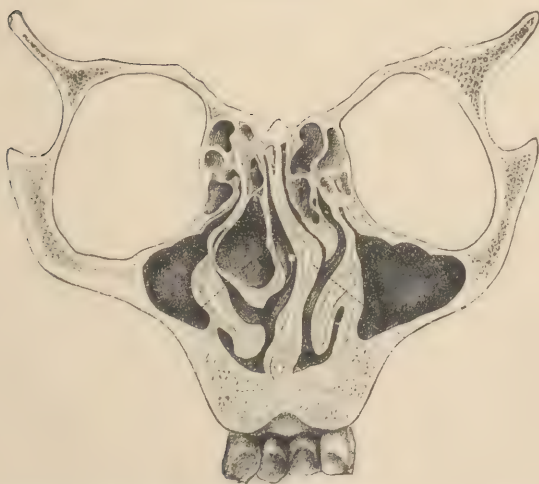
TRANSVERSE SECTION THROUGH THE FRAMEWORK OF THE SUPERIOR MAXILLA, POSTERIOR SEGMENT (Zucker-kandl).—The right maxillary antrum, *a*, is capacious; the left, *b*, is contracted by the encroachment of the outer maxillary wall, *c*.

FIG. 25.



CONTRACTION OF THE MAXILLARY SINUSES IN CONSEQUENCE OF EXCESSIVE OUTWARD DEVIATION OF THE EXTERNAL NASAL WALLS (Zuckerkindl).—*a*, nasal cavities; *b*, *b*, contracted maxillary sinuses; *c*, *c*, deviating outer nasal walls; *d*, infra-orbital nerve, to which one of the deviating walls extends.

FIG. 26



SIGMOID DEFLECTION OF THE SEPTUM, PROBABLY THE RESULT OF FRACTURE (Zuckerkindl).

in the parents could be obtained ; and because the personal history of the patients did not show any traces of acquired syphilitic infection, it is difficult to assign any plausible cause for the systemic dyscrasia giving rise to the self-limited ulcerative process.

DEFORMITIES.

The deformities met with in the nose are either congenital or acquired, and the former class mostly consists in the absence of parts of the nasal cavities. Inasmuch as this article is devoted to neoplasms and their effect upon nasal respiration, it is unnecessary to consider any such deformities, and only those which might give rise to a mistake in the diagnosis will have to be mentioned. The most common form of such derangement of the nasal parts is deviation of the septum, which occurs either in the bony or in the cartilaginous plates, or it may be present in both at the same time. It is difficult to arrive at a definite origin of this deformity, and to call it either congenital or acquired, because the development of the vomer and the fusion of the turbinated bones are not completed until near the age of puberty (Zuckerkindl).¹ Therefore the large number of deviations of the bony septum found in dry skulls by Mackenzie,² Allen,³ Zuckerkindl,⁴ and other observers can really not be considered as congenital, but must be looked upon as the result of intra-nasal pressure, on one or the other side, during the period of development between birth and puberty.

Bosworth⁵ combats the view expressed by the writer⁶ that hypertrophic rhinitis will cause deviation of the septum, and remarks that the reverse is true,—viz., that the deviation is either congenital or due to traumatism, and that the hypertrophic catarrh is caused by the deviation of the septum. However this may be, it is the clinical experience of many rhinologists that deviation of the cartilaginous portion of the septum, at least, is in most cases due to pressure on the opposite side. (Figs. 23, 24, and 25.)

Various forms of deviation of this lower portion of the bridge are observed, the most common of which is a bulging of the cartilage until it occludes the nostrils, with a corresponding depression or concavity on the opposite side. There may be also in some cases a sigmoid flexure (Fig. 26) occluding one nostril low down and the other higher up. Another form is a bulging to one side, and a projection of the anterior margin of the cartilaginous plate into the opposite nasal cavity, thus occluding both nasal chambers. Sometimes cases are met with in which the two plates of the cartilaginous portion have become separated, and the lower free edges flare

¹ Op. cit., p. 100 *et seq.*

² Op. cit., vol. ii. p. 424.

³ Loc. cit.

⁴ Op. cit., pp. 99, 100.

⁵ Op. cit., p. 293.

⁶ New York Medical Journal, February 18, 1888, p. 180.

like the tail of a swallow, occluding both nostrils (Fig. 27). This variety is usually due to blows directly upon the bridge of the nose in a vertical line, thus forcibly separating the two plates. But this separation may also be caused by an accumulation of pus in Jacobson's organ, in which instances a small perforation is generally seen.

FIG. 27.



Split septum.

As a rule, these deviations produce little or no deformity of the external contour of the nose. If, however, the pressure due to hypertrophic rhinitis, or polypus, or a foreign body, has begun in early childhood, and has been unilateral only, a leaning over towards the opposite side of both the cartilaginous and the bony plates of the septum occurs, and the nose becomes more and more crooked as the child grows older.

The symptoms to which such a deformity gives rise are those of unilateral or bilateral nasal obstruction, and need not here be reiterated. The differential diagnosis is easy to the experienced rhinologist, because there is no new growth or abnormal condition in the nose for which deviation of the septum could possibly be mistaken, when the nasal cavities are carefully explored with the rhinoscope, the speculum, and the probe.

Bony occlusions of the post-nasal orifices, which are usually congenital and are extremely rare, have already been mentioned in the foregoing pages, and the same is true of splitting of the middle turbinated bone, and also of the uncurling of the middle or lower turbinated bodies. As a last, but extremely rare, deformity, mention should be made of a bladder-like expansion of one of the turbinated bones, resembling a bony tumor in its contour, which as described by Zuckerkandl¹ is, however, nothing but a thin shell of bone covered with mucous membrane and filled with air.

¹ Op. cit., p. 44.

SURGICAL PROCEDURES IN DEFORMITIES AND NEOPLASTIC GROWTHS IN THE NOSE.

BY WILLIAM CHAPMAN JARVIS, M.D.,

Professor of Laryngology and Diseases of the Nose and Throat, New York University Medical College; Consulting Physician to Out-Patient Department, Bellevue Hospital; Visiting Physician to Charity Hospital, etc., New York.

THE successful practice of intra-nasal surgery largely depends upon the proper utilization of a form of applied mechanics derived from a practical knowledge of approved pathology and diagnosis. Through the introduction of the wire *éraseur*, as has been indicated by Sir Morell Mackenzie,¹ it has been made to differ from general surgery in that it permits some relaxation of the rule under which surgeons were taught "to cut through everything soft, to saw through everything hard, and to tie everything that bleeds."

In view of the importance most properly attached to antiseptis, anæsthesia, and hemorrhage, in the practice of nasal surgery, a preliminary consideration of these subjects is deemed desirable, in order to prevent unnecessary repetition.

ANTISEPTIS.

In dealing with the question of precautionary antiseptis, it must be borne in mind that injury to certain intra-nasal structures is more likely to be followed by the occurrence of septic symptoms than injury to other parts of the same cavity.

Operations upon the septum, judging from the records of the subject, are particularly liable to be followed by sepsis. By an *a priori* method of reasoning, this accident may, perhaps, be attributed to the peculiarity of the septum, its cartilaginous or osseous character, as with joints, rendering it more susceptible to the absorption of morbid material, or to the character of the instruments employed; saws, multiple-knife drills, etc., being more efficient sepsis-carriers than hot or cold wire.

The incandescent platinum wire is, of necessity, typically aseptic. The cold wire, though in a different manner, is likewise peculiarly aseptic in its action, from the practice of employing fresh loops, and because of the

¹ Diseases of the Throat and Nose, 1884.

crushing action serving as a ligature to shut off communication between the active absorbents and extraneous septic matters in the same manner that it prevents hemorrhage.

The absolute absence of septic symptoms among patients operated upon in dispensary practice by means of the cold-wire *écraseur*, which may not, in the hands of careless operators, have been properly sterilized for months at a time, affords convincing evidence upon this point.

I am inclined to believe, furthermore, that certain post-operative manifestations referred to, for instance, as surgical fever, etc., are in reality to be viewed as septic. Records of septicæmia supervening after the use of nasal tampons,¹ etc., clearly indicate such a possibility and demonstrate the necessity of employing perfectly aseptic nasal plugs.

The preceding remarks naturally imply the necessity of sterilizing both the instruments and the dressings employed in intra-nasal procedures, particularly when these measures are directed against the septum.

Surgical drills and saws should be boiled and burnished after each operation, and bichloride of mercury dressings or other fitting substitutes should alone be allowed to remain in the nasal cavities for any length of time.

Hemorrhage.—In the practice of all the ordinary intra-nasal procedures, the skilful and properly-equipped operator need never have occasion to contemplate seriously the occurrence of hemorrhage. Except in the treatment of pulsating angiomas and certain telangiectatic neoplasms, extraordinary precautions are rarely required.

Surgical nasal hemorrhage, especially from the septum, is significant only as a temporary mask to the field of operation. The hæmostatic action of cocaine has greatly reduced this inconvenience, and the *écraseur* and the hæmostatic clamp, when conveniently utilized, have entirely abolished it.

General Anæsthetics.—Of the general anæsthetics, ether, chloroform, and nitrous oxide, the last-mentioned, when possible, should receive the preference; chloroform, when used just short of its complete abolition of voluntary movements, is next in choice. Ether is the least convenient of the three, by reason of its explosiveness when in proximity to the laryngoscope. Cocaine, however, should render recourse to general anæsthetics comparatively rare.

Local Anæsthesia.—With regard to the employment of local anæsthetics, those having a topical action are, when feasible, to be given the preference. Of these, cocaine has certainly received by far the largest endorsement, as determined by common usage. It may be advantageously employed upon a pledget of cotton or sprayed into the nostril, or in both of these ways. Strong solutions, from twenty to thirty per cent., are more advantageously employed.

Purified rhigolene, when properly employed with the cold-wire loop, invariably insures a painless and bloodless operation by reason of its

¹ Verneuil, *Tribune Médicale*, 1887.

marvellous refrigerating action on the tissues. A certain amount of care and skill must be exercised in its employment.

The surgical management of the more common intra-nasal pathological conditions may be conveniently considered under the following divisions, in the order of the frequency of their occurrence,—namely, hypertrophy of the turbinated tissues, deflection of the septum, neoplasms, and miscellaneous conditions.

HYPERTROPHY OF THE TURBINATED TISSUES.

Indications.—Removal of the turbinated bodies in a state of hypertrophy is principally indicated for the relief of nasal stenosis and the immediate results, habitual mouth-breathing, rhinorrhœa, and excessive accumulation of nasal mucus; as well as of the more remote results, disease of the middle ear, obstruction of the lachrymal duct, naso-pharyngitis, laryngeal hyperæmia, laryngitis, and secondary pulmonary disease.

The removal of the turbinated tissues is also indicated for the relief or removal of various reflex neurotic conditions directly or indirectly traceable to these structures when in a state of irritative hypertrophy. The following reflex neuroses may occur in the nose,—viz. : sternutus, hyperæsthesia, hay-fever (Daly,¹ Mackenzie,² Roe³), tinnitus aurium (Burnett⁴), pharyngeal or laryngeal irritation, direct or indirect, from habitual mouth-breathing, bronchitic asthma (Bosworth⁵), photophobia or asthenopia (Cheatham,⁶ Gruening⁷), cephalalgia, vertigo, gastralgia, and dyspepsia (Hack⁸), neurasthenia (North⁹), and sexual neuroses (J. N. Mackenzie¹⁰).

Historical and Critical.—The methods commonly employed for the permanent removal of turbinated redundancies may be conveniently considered under two heads : reduction and excision.

Reducing agents act either upon the principle of absorption, by shrinkage, or by gradual exfoliation.

Chemical Caustics.—The caustic method is by far the most popular. It accomplishes the result by the exfoliation or superficial erosive action of the local sloughs generated by the repeated application of various caustics combined with a certain amount of cicatricial contraction. Prominent among these chemical agents may be mentioned London paste (M. Mackenzie), chromic and glacial acetic acid (Bosworth), nitric acid (Lefferts), chloride of zinc and nitrate of silver (Schrötter).

¹ Archives of Laryngology, 1882.

² Diseases of the Throat and Nose, 1884.

³ Medical Journal, 1883.

⁴ Philada. Medical News, 1884.

⁵ Medical Journal, 1886.

⁶ American Practitioner and News, 1887.

⁷ Medical Record, 1886.

⁸ Wiener Medicinische Wochenschrift, 1883.

⁹ Bosworth, Diseases of the Nose and Throat, 1889.

¹⁰ Medical Record, 1884.

Electric Caution.—The turbinated structures may likewise be reduced by the application of the electric cautery. While the galvano-cautery, as a reducing agent, possesses the advantage of permanency in its effect, it is not entirely free from certain objections attending its use. This means, as generally applied in the form of the incandescent platinum point, accomplishes the desired object through the extraordinary cicatricial contraction incident to the healing of the furrows burned into the obstructing turbinated tissues. The common forms of electric apparatus employed for this purpose are the plunge-battery and the storage-cell. Both accomplish this object in a satisfactory manner, the preference lying mainly in the matter of cell-construction. The two most convenient forms of plunge-batteries known to me are those of Dr. Seiler, made by Fleming, of Philadelphia, and of Dr. Robinson, sold by Stammers, of New York. The thermo-cautery (Goodwillie), utilized by means of the Paquelin apparatus, is seldom used.

Storage-batteries, of which a large number of manifold form and make are obtainable, also constitute a convenient means for the supply of electric power for galvano-cautery purposes. Though possessing a much greater degree of indestructibility and endurance than the gravity-cell, even these devices eventually become useless through corrosion of their plates. The only absolutely reliable and practically indestructible source of electrical supply is to be had in the employment of a properly-constructed rheostat connecting with the street-main of an electric-power dépôt. Lack of general availability is the only serious objection that can be urged against this method.

While there is no doubt as to the ability of caustics effectually to reduce turbinated redundancies, it must be remembered that their employment requires great nicety of manipulation and perseverance on the part of both physician and patient, involving a large expenditure of time, and that their use is not devoid of painful secondary results, œdematous inflammation and agglutination of the injured surfaces. Among other forms of reducing agents are the metallic sound (Wagner's¹), electrolysis,² laminaria tents (Justi's³), compressed sponge (Cohen⁴), hypodermic medication, ergotine (De Blois⁵), and carbolic acid (Henderson⁶).

The metallic sounds accomplish the result by absorption and require "weeks of treatment." The ergotine injections act by "curtailing blood-supply." The carbolized injection acts by interstitial sloughing. It is clear that all these methods, whilst doubtless effectual to the full amount claimed by their respective advocates, are nevertheless open to the objection of temporizing with pathological conditions susceptible to prompt treatment

¹ Diseases of the Nose, 1884.

² Robinson, Nasal Catarrh, 1885.

³ Wiener Medicinische Wochenschrift, 1880.

⁴ Diseases of the Throat, etc., 1879.

⁵ Archives of Laryngology, 1883.

⁶ St. Louis Medical and Surgical Journal, 1886.

by the employment of more radical and satisfactory measures, by which they should be replaced whenever possible, even if only in deference to the maxim *Ars longa, vita brevis*.

Methods of Excision.—Among the more important methods of excision are found the tearing away of the tissues by means of the forceps (Robinson¹), canula-scissors (A. H. Smith), scissors (Daly), nasal plough (Woakes²), hot-wire (Sajous³) and cold-wire *écraseur* (Bosworth,⁴ Robinson, Seiler,⁵ Lefferts,⁶ J. N. Mackenzie,⁷ M. Mackenzie,⁸ Knight⁹).

With regard to the forceps and scissors, it may be added that serious hemorrhage is likely to follow the extensive tearing of the turbinated tissues. The same objection holds against the knife-plough and scissors. The combined favorable experience of the more prominent operators has resulted in the almost universal adoption of the cold-wire *écraseur* as the best means for the removal of all varieties of turbinated hypertrophies.

Special Procedures.—The first operation devised by me for the removal of enlargements of the posterior turbinated bodies is based upon the peculiar form assumed by these structures in a state of hypertrophy.¹⁰

The posterior surfaces of these bones, especially of the inferior, show a peculiar constriction formed by the hypertrophied tissue extending backward into the upper pharynx. The extreme point of the growth is thus thrown beyond its base.

This constriction forms a nidus for the retention of the *écraseur* wire. (Fig. 1.)

The *écraseur* (Fig. 2, C) consists of a long and short canula, the latter of which glides over a screw-thread cut on the former, and about the size of a No. 3 sound, English scale. A milled nut fitting this thread is intended to push the outer canula before it. Well-tempered steel wire (No. 5 piano gauge) is drawn through the large canula, and its ends are attached to the retention pins on the smaller one. As the outer canula cannot turn, there is no twisting of the wire loop formed.

The Combined Mirror and Tongue-Depressor (Fig. 3).—A stout wire, after being made to divide and assume the form of a tongue-depressor, is crossed upon itself and then shaped into a pincette. Mirrors of different sizes are received between the pincette's blades. These mirrors can be placed at any desirable angle with the shaft. The hinge-joint will permit the

¹ Nasal Catarrh, 1885.

² Post-Nasal Catarrh, 1884.

³ Diseases of the Nose, 1884.

⁴ Jarvis's Operation, Medical Record, 1881.

⁵ Ibid.

⁶ Chronic Nasal Catarrh, 1886.

⁷ Reference Handbook of the Medical Sciences, vol. viii.

⁸ Diseases of the Nose, 1885.

⁹ Medical News, 1882.

¹⁰ Archives of Laryngology, 1881.

mirror to be fixed at the most favorable angle for viewing the posterior nares, and at the same time will facilitate depression of the tongue.

This instrument will sometimes be found a convenient one, as it enables

FIG. 1.

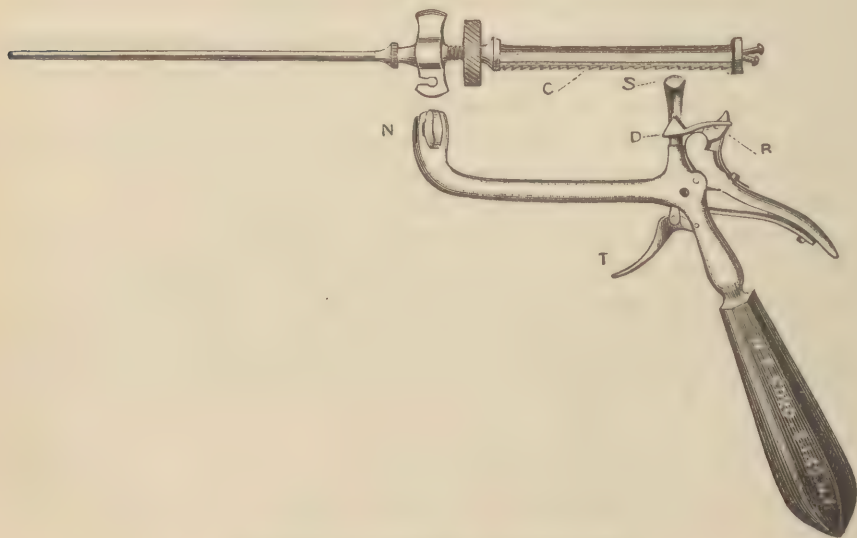


Pathological specimen of posterior hypertrophy, showing snare-loop in position. (From the author's collection.)

the operator to bring the posterior nares into view with one hand, leaving the other free for the manipulation of the *écraseur*.

The tape-holders (Fig. 3) are intended to obviate the unsatisfactory and disagreeable manipulation of tying the ends of the tape which pass around the soft palate in cases requiring this procedure. They are two

FIG. 2.

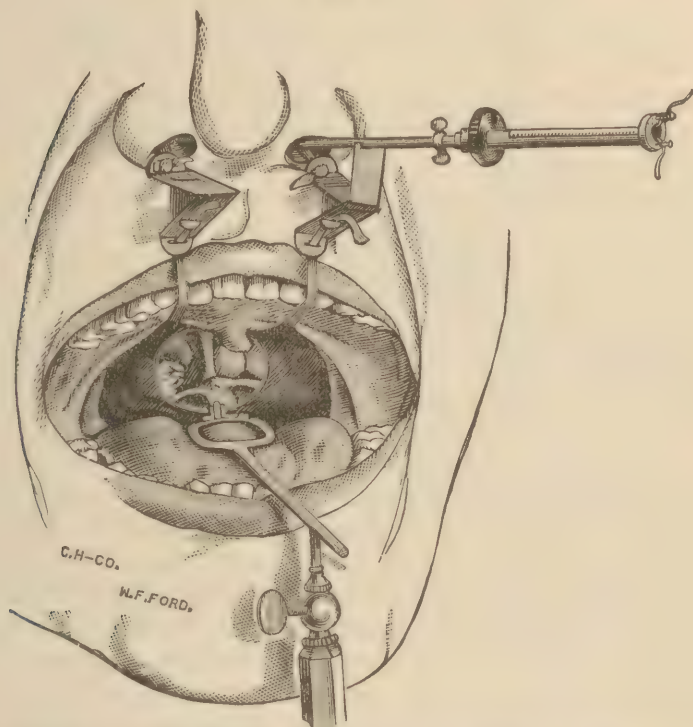


The author's nasal *écraseur* and polypus snare.

small V-shaped spring-clips, so arranged that the tape passing through apertures in its blades is caught by a tooth-like projection and firmly held. Pressure on the spring releases the catch and sets the tape free.

The transfixion-needles (Fig. 4) need no special description. They are pointed like the ordinary glover's needle. Four different sizes are made,

FIG. 3.



Removal of posterior turbinated hypertrophies, with author's rhinoscope and tape-holders in position.

running from one to four inches in length. Each number has a straight needle and three others of varying curves. They are all furnished with a light, convenient handle.

In using the *écraseur* pass the two ends of the wire through the canula, entering them at its distal extremity, and twist them round the retention pins. A loop is formed whose size depends, of course, upon that of the growth. Giving the wire loop a twist towards the side of the nose occupied by the growth, it is fixed by a turn of the nut and passed into the nostril.

Holding the rhinoscopic mirror in one hand, the position of the wire loop in the posterior nares is carefully watched, whilst it is steadily advanced with the other hand until it is seen to encircle the growth. (Fig. 3.) In drawing the wire home the tissue is cleanly divided, and, if not too large to pass through the nares, it will generally be drawn out clinging to the snare.

FIG. 4.



Author's transfixion-needles.

Make traction very slowly, stopping at short intervals in order to prevent hemorrhage. An hour or more may sometimes be profitably consumed to insure a perfectly bloodless procedure. If the nostril is obstructed by a deviated septum, or narrowed by any other cause, it may be necessary to introduce the wire sheathed in the main canula, when, by projecting the loop within the naso-pharyngeal space, the growth can be readily snared. Long experience in the use of the *écraseur* should enable the operator to engage posterior hypertrophies with ease and precision without having recourse to posterior rhinoscopy.

A perfect knowledge of the exact location of the hypertrophies, and careful utilization of a cultivated sense of touch, are the important factors for the successful accomplishment of this procedure. Cocaine, if used, should be employed only after the hypertrophy has been engaged in the loop, since its contractile action upon the turbinated structures, when used at the start, may in some instances defeat the object of the operator by causing obliteration of the necessary pathological nidus already referred to.

The hemorrhage resulting from the practice of this procedure is usually trifling, and sometimes nil, provided due caution is observed to make slow traction. Dr. Bosworth's suggestion to leave the tissues undisturbed after their complete division, in order to avoid the occurrence of hemorrhage, may sometimes be found useful. On the other hand, I have known the hasty and careless employment of this method on the part of certain operators to be followed by alarming and persistent hemorrhage, which, upon investigation, invariably proved to be due to a flagrant violation of the commonplace rules laid down for the successful performance of this operation.

Soft, sessile hypertrophies occurring in any part of the nostril can be easily removed, as the wire readily sinks into the tissue and takes firm hold on the growth. Firm, non-pedunculated posterior hypertrophies require both *écraseur* and transfixion-needle. (Fig. 4.) In using the transfixion-needle, the amount of tissue requiring removal is carefully determined, and the point of the needle directed accordingly. The loop will be caught by the point of the needle projecting into the nostril (Fig. 5), and a few turns of the milled nut cause the wire to sever the transfixed tissue. In transfixing posterior hypertrophies the position of the needle's point can be determined by means of the rhinoscopic mirror. Curved needles should be used in transfixing anterior hypertrophies in order to bring the needle's point into view. A little practice will enable one to determine when complete transfixion has taken place, by the sense of touch, in cases where the needle's point cannot be seen. Nasal hypertrophies of every size and description can be permanently abolished by the practice of this simple method. The discomfort caused in removing these growths will vary with the susceptibility of the patient to pain and the amount of care used in manipulating the *écraseur*. Patients, as a rule, declare that they do not suffer.

The rules just given for the employment of cocaine to prevent pain in

the removal of posterior hypertrophies apply in an equal, if not greater, degree when this analgesic is used in anterior forms of this growth. Unless markedly rugous, the retraction is likely to render the hypertrophy difficult of seizure by means of the naked wire loop. This difficulty, however, is obviated by the use of the transfixion-needle in conjunction with the wire loop, since the retracted tissue may be actually stripped from the turbinated bones without fear of evil consequences.

A bloodless cocaine procedure of this character does not mean certain immunity from secondary hemorrhage, against the occurrence of which it is well to make ample provision.

A pledget of cotton thrust into the nostril will generally suffice to control any slight hemorrhage that may occur. It is not necessary to exercise much care to prevent bleeding from anterior hypertrophies, as the hemorrhage is but transient.

DEFORMITIES OF THE SEPTUM.

The indications for the correction of the deviated septum are largely those mentioned under the head of turbinated hypertrophies, with the additional feature of their agency as an especial cause in the development of catarrhal disease and nasal myxomata.

Historical and Critical.—The first systematic presentation of the subject of deflection of the nasal septum, with its special treatment, appears to have been made by Quelmaltz¹ in the eighteenth century. His suggestion to overcome the deformity by the employment of continual finger-pressure upon the tip of the nose has been advocated in more modern times (1876) by Michel. This method is obviously of doubtful efficacy and, for general purposes, useless, reminding the reader of the physical acts accomplished by posture among the dervishes, some of whom have been described as spending their lives contemplating the tip of the nose from eighty-four different postures.²

The somewhat ancient method of Chassaignac³ might perhaps be

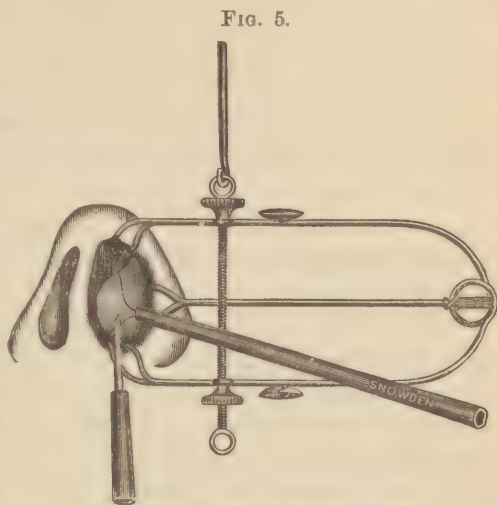


Fig. 5.
The author's transfixion-needle and éraseur adjusted for the performance of the operation. (From Dr. Sajous's work on Diseases of the Nose and Throat.)

¹ De narium earumque septi incurvatione, 1750.

² Encyclopædia Britannica, 1878.

³ Bulletin de la Société de Chirurgie, 1851-52.

properly cited as next in order of crudity. It consisted in paring off the cartilaginous projections piecemeal with a knife. The matter of hemorrhage must obviously interfere with the satisfactory completion of such a procedure, and I recall a case recited to me of an operator who was compelled to abandon the operation on this account, after etherizing his patient.

The knife operation has been much improved by Dr. Ingals,¹ who devised a special plan for combating the hemorrhage. The knife is also advocated by Stoker,² Schech,³ Jurasz,⁴ and Dieffenbach.⁵

A modification of this method is reported by Dr. B. Robinson⁶ as having been employed by Dr. A. C. Post, consisting in dissecting away the nasal integument and ala nasi, exposing the septum, and removing it through the flaps.

This is clearly an unnecessarily formidable method, and, judging from a case which recently applied to me for operation after this procedure had been unsuccessfully practised, it is not even reliable. Small low spurs upon the superior maxillary portion of the septum are removed by Dr. H. Allen⁷ by dissecting up the gingival aspect of the upper lip, and in this way exposing the vestibule and operating per os,—a rather severe procedure, it seems to me, for the correction of a very simple pathological condition.

Saw.—From the knife to the saw—an amplified knife—is but a step. And here we meet with an operation which has become popular on account of its simplicity and the eminence of its propagators, Bosworth, and others.

Dr. Bosworth⁸ credits Seiler with being one of the first to use the metacarpal saw; but Bosworth himself greatly improved the shape and cutting power of this device. The objectionable feature of hemorrhage exists with this device as with the knife, but to a smaller degree, by reason of the crushing power of the saw's teeth.

Roe⁹ has utilized a form of eccentric motion, imparted by an electric motor, to accomplish the saw motion. J. Wright¹⁰ perforates the septum longitudinally and saws between the openings. Chisels have been skilfully employed by Seiler.¹¹ Blandin,¹² supported by Goodwillie,¹³ used a punch, with which he perforated the deflected septum at the most prominent point upon its anterior aspect. With deep-seated deflected septa an anterior connection between the open and closed nostrils is to be obviously viewed

¹ Transactions of the American Laryngological Association, 1882.

² Deviations of the Nasal Septum, 1888.

³ Die Krankheiten der Mundhöhle, des Rachens und der Nase, 1890.

⁴ Ueber die Behandlung hochgradiger Verkrümmungen der Nasenscheidewand, 1882.

⁵ Chirurgische Erfahrungen, 1834.

⁶ Nasal Catarrh, 1885.

⁷ Philadelphia Medical News, 1890.

⁸ Diseases of the Nose and Throat, 1889.

⁹ Transactions of the American Laryngological Association, 1888.

¹⁰ New York Medical Record, 1890.

¹¹ Ibid., 1888.

¹² Compendium de Chirurgie, tome iii.

¹³ Medical Gazette, 1880.

more as a psychical impression than as a real factor for the radical relief of nasal stenosis.

Watson¹ advocates the practice of Adams's operation for the removal of extensive deformities of the nasal septum, which has for its object the breaking up of the osseo-cartilaginous septal framework by means of a specially-devised "fraction-forceps." Rendered plastic by this means, they are then retained in position by means of intra-nasal plugs or complicated external nasal splints. Jurasz² has modified Adams's forceps by making the blades serve the double purpose of a septoclast and an intra-nasal splint-plug.

This operation is very severe and unreliable, and is now seldom employed. A modification of Blandin's operation has been advanced by Steele,³ who employed a stellate punch to obtain mobility of the deflected cartilaginous septum. J. N. Mackenzie credits Bolton,⁴ of Virginia, with being the original inventor. A more extended account of this device will be found under the head of special operations in treatment of the septum. Asch⁵ has devised an ingenious but extremely complicated substitute for Steele's operation. Roberts⁶ employs pins to keep the fragments in position. The merits and demerits of the stellate punch procedure are explained in a subsequent paragraph. Dr. J. Solis Cohen⁷ was among the first to recommend the employment of drills propelled by means of the surgical engine worked by a pedal. A description of the more convenient electric motor substituted by myself will be found under the proper head in the main body of the text. Goodwillie⁸ employs shielded "multiple knives." Curtis⁹ utilizes the trephine. Properly-constructed nasal drills offer one of the very best means at our disposal for the exsection of the septum. Like the saw, they require especial oversight to prevent septic accidents. Lennox Browne,¹⁰ Voltolini,¹¹ Schaeffer,¹² and Walsham¹³ recommend the galvano-cautery, the sphere of which is limited, of course, by bone. So, too, does Sedziak.¹⁴

Electrolysis is employed by Moure and Bergonié.¹⁵ It is to be viewed more in the light of a curious mechanico-therapeutical feat than in that

¹ Diseases of the Nose, 1875.

² Op. cit.

³ St. Louis Courier of Medicine, 1879.

⁴ Richmond Medical Journal, 1868.

⁵ Transactions of the American Laryngological Association, 1890.

⁶ Philadelphia Polyclinic, 1884.

⁷ Philadelphia Medical and Surgical Reporter, 1878.

⁸ Medical Gazette, 1880.

⁹ New York Medical Journal, 1887.

¹⁰ Diseases of the Throat, 1887.

¹¹ Die Krankheiten der Nase, 1888.

¹² Chirurgische Erfahrungen in der Rhinologie und Laryngologie, 1885.

¹³ Journal of Laryngology and Rhinology, 1890.

¹⁴ Ibid., 1891.

¹⁵ Ibid., 1890.

of a valuable mode of treatment. Stoker¹ and Hubert² recommend lamina bougies and cotton tampons. Massei favors compressed air. John N. Mackenzie³ urges the removal of the inferior turbinated body as a substitute for excision of the septum, in certain cases. Delavan⁴ advises excision of the middle turbinate.

Special Operations on the Septum.—*The Écraseur.*—The écraseur employed is the same device as Fig. 2, described under the head of turbinated bodies and recommended for the removal of these structures in a state of hypertrophy.

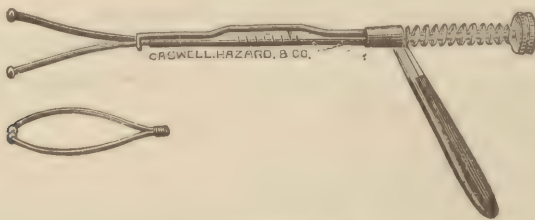
FIG. 6.



Author's operating speculum.

For opening the field of operation I employ my ring-drop nasal speculum (Fig. 6), since in my hands it has proved the best for painlessly and persistently dilating the nostrils. In the treatment of cartilaginous and soft structural deviations of the septum I at one time employed nothing more than my écraseur with transfixion-needles. Instead of using the No. 5 piano wire originally recommended and introduced by me for the removal of turbinated hypertrophies, I employ Nos. 0 and 00 piano wires. The exclusion of the question of hemorrhage in operations by écrasement is an additional recommendation for the employment of fine wires cutting like knives. The employment of the écraseur for this purpose must be invariably combined with the use of my transfixion-needles. These needles (Fig. 4) have been already described.

FIG. 7.



Author's septometer.

Operation.—The amount of tissue requiring removal is generally estimated by comparing the redundance with the unaffected portion of the septum. This having been carefully determined by means of the septometer

¹ Deviations of the Nasal Septum, 1868.

² Münchener Medicinische Wochenschrift, 1886.

³ New England Medical Monthly, 1885.

⁴ New York Medical Journal, 1887.

(Fig. 7), the base of the cartilaginous projection or hypertrophied tissue is pierced with the transfixion-needle until the point reappears. The wire loop of the écraseur is now passed over the point of the needle projecting into the nostril, and tightened around the transfixed tissue by forcing up the outer canula with a movement of the finger against the milled nut. A few turns of the milled nut cause the wire to sever the transfixed tissue.

When the posterior surface of the deviated tissue is not well defined, it is advisable to use a curved needle in order to bring its point in view. A little practice will enable one to determine when complete transfixion has taken place, by the change in resistance appreciated by the touch in cases where the needle's point cannot be seen.

When the cartilaginous or thickened tissue is in contact with the outer wall of the nose, I make use of the No. 3 curved transfixion-needle (Fig. 4), which has its point at a right angle with the shaft. By successively hooking and snaring off pieces of the septum, it is possible to make an opening into the posterior nares. The patient practice of this method has enabled me to perforate even an imperforate nostril without connecting the nasal cavities by an undesirable opening.

The removal of cartilaginous and soft deviated tissues by écrasement has been followed by most excellent results in my hands, and where there is plenty of time at the operator's disposal it is to be preferred for this purpose.

This operation can, of course, be rendered painless and bloodless by the employment of my hæmostatic clamp (Fig. 8) and cocaine whenever possible, and is probably the least painful and bloody of all the radical procedures when practised without these aids.

Operations on the Septum with the Forceps.—It is often desirable to economize time, and in order to do so I have devised instruments with which I have most satisfactorily accomplished this purpose. This brings me to an operation which I will, for convenience, term my scissors and forceps procedure. These instruments are essentially for cutting, and consist of a fenestrated cartilage-forceps, trimming-scissors, and transfixion-scissors. Their blades are made almost at a right angle, to enable the operator to obtain a clear view of the field.

The cutting edges of the fenestrated forceps (Fig. 9) resemble somewhat, in shape and action, the ordinary ticket-punch. A ring on the fixed blade is intended to slip over the middle finger, and a knob on the free one is manipulated with the thumb. This arrangement enables one to seize and divide the cartilage with great facility. The trimming-scissors are convenient for removing asperities remaining after the other instruments have been employed. The instrument is grasped like a pistol, firm pressure being exercised against its lateral margin by the index finger.

The transfixion-scissors, as their name implies, possess needle-like

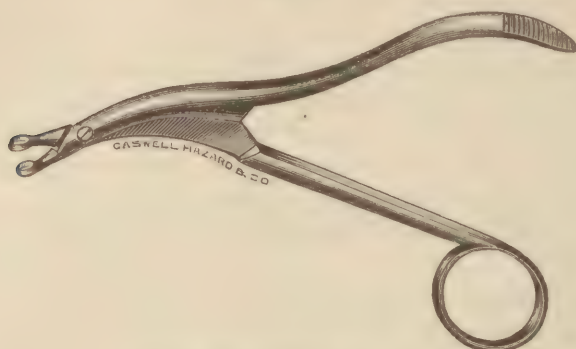
FIG. 8.



Author's hæmostatic clamp.

points to facilitate piercing of the cartilage of the septum, and may be ground to cut by either closing or opening the blades, their general form being similar to that of the preceding devices.

FIG. 9.



Author's small septum scissor-punch.

Thus far the instruments shown have applied only to cartilage and hypertrophied mucous membrane. Bone blunts or breaks their keen edges, and we may have to treat an osseo-cartilaginous deviation of the septum.

The little instrument (Fig. 10), essentially a rongeur forceps, has, in my hands, most satisfactorily accomplished this result. Its two blades are hollowed to cut like the teeth of a rodent. The instrument has the proper nasal curve.

A great advantage possessed by this bone-forceps is the control exercised

FIG. 10.



Author's rongeur septum-forceps.

over it by the operator. Each osseous projection can be plainly distinguished over the edge of the upper blade and deliberately crushed away by the keen-edged cutting surfaces, and by a kind of gnawing process large sections of the bone are removed with rapidity and precision. All the methods thus far mentioned accomplish their purpose by removing the superfluous or deviated tissues or the turbinated structures opposite the deviated point.

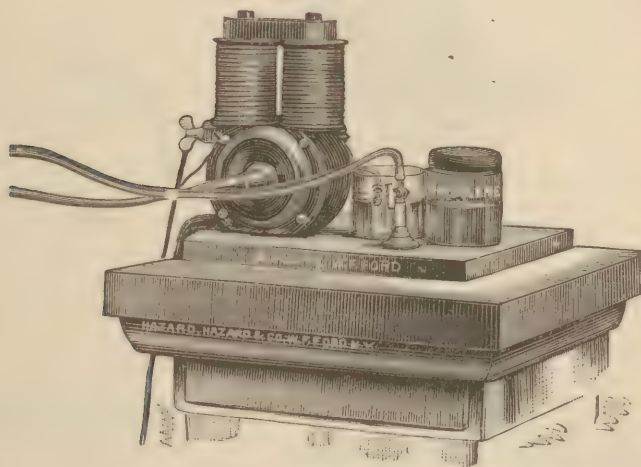
My remarks concerning the employment of the hæmostatic clamp to prevent pain and hemorrhage will, of course, apply in this procedure, when the deflected structures are located within easy reach.

The foregoing procedures are particularly commendable on account of their combining the qualities of simplicity, portability, and availability. When rapidity and expedition are viewed as particularly desirable or of pre-eminent importance to either surgeon or subject, or to both, the surgical drill propelled by electricity is, unquestionably, the most satisfactory means at our disposal.

The Surgical Drill.—A sufficient experience with the common treadle surgical engine, and particularly with an improved form of this apparatus invented and used by me during an extended period for intra-nasal operations, has convinced me that the natural dread occasioned by the sight of the cumbersome and rapidly-revolving, noisy machinery constitutes a hinderance to the usefulness of the nasal drill. This sometimes serious objection, though mostly of a psychical nature, is effectively overcome by the employment of the electric motor. Concealed in its narrow shell suspended in mid-air, but few patients can form an idea of the great mechanical possibilities possessed by this apparently insignificant mechanism.

I now employ the compact C and C electric sewing-machine motor. (Fig. 11.) Inasmuch as this instrument has proved in my hands the de-

FIG. 11.



C and C electric motor.

sideratum sought for, I shall give it exclusive attention, referring to other motors for purposes of comparison only. There is absolutely no dead-point, a prevalent objection to electric motors, and the common annoyance of laboriously adjusting the armature at intervals during an operation is, by this device, relegated to the inconveniences of the past.

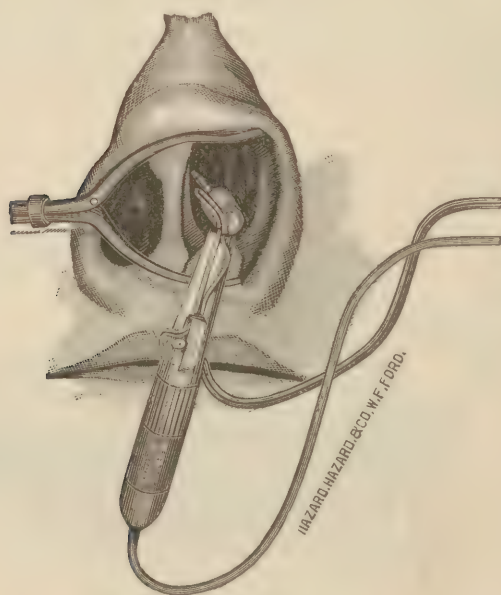
The counter-electro-motive force generated by the motor running at eighteen hundred turns a minute, with an eighteen-ampère current in the field,

is five volts. The revolutions can be carried as high as two thousand to the minute. Its extreme capacity equals one-eighth horse-power.

A single quantity-cell supplies electro-motive force for any ordinary nasal operation; two of these cells furnish an excess of power, even in operations including the densest portion of the vomer. My electro-motive force is derived from storage-cells, which a somewhat extended experience has induced me to view as the most powerful, reliable, and, in the long run, cheapest device obtainable for combined cauterizing, illuminating, and motor purposes. To facilitate the attachment of the flexible shaft, I have had constructed a metallic sleeve which slips over the journal-box of the motor. Within this sleeve is an angular rod soldered to the flexible cable, which slips in a groove cut into the centre of the axle of the armature. The free movement of this rod within the groove favors the flexion of the cable and permits the shafting to be quickly attached or withdrawn. The electric motor can be used either attached to a convenient table or suspended by wires from the ceiling.

The wires running from the battery are interrupted before reaching the

FIG. 12.



Weber's hand-piece for drills.

motor and arranged upon a foot-board. The convenient cut-off thus formed is simply composed of a sheet of spring brass, which the pressure of the operator's foot brings in contact with a button through which the electric current is conducted to the motor.

The employment of small nasal drills, already referred to, I desire to lay particular stress upon as constituting a desirable digression from the routine course, heretofore pursued, of resorting to large and cumbersome

devices of the kind in operations upon the nose. To facilitate the practice of keeping the parts operated upon constantly in view, the dimensions of the drill must necessarily be made small. When large drills are employed,—the ingenious shielded multiple-knife of Dr. Goodwillie, for example,—a view of the field of operation is rendered difficult or impossible, and the operator is compelled to rely upon his acquired *tactus eruditus*, to the exclusion of his sense of sight.

The long practice required to attain the necessary tactile proficiency to operate with precision, though blind to the exact behavior of the drill, it seems to me, must seriously interfere with the extensive adoption of large nasal drills in general practice. Furthermore, surgeons will naturally hesitate to permit keen-edged cutting instruments to revolve rapidly out of sight in close contiguity to the brain beneath the frail plate of the ethmoid. The extreme narrowness of the superior meatus makes it impossible satisfactorily to employ shielded drills in this region. Contrary to the teachings of the advocates of the *tactus eruditus*, my rule is to direct the burrs exclusively by the sense of sight, and I adopt as a precaution the maxim, "Never lose sight of the drill."

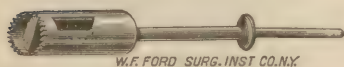
The hand-piece employed by me (Fig. 12) as a drill-holder, invented by Mr. Weber, has the great advantage of clutching the drills after the manner of a powerful chuck.

It is my custom in operating with the drill to dilate the nostril gently by means of my operating nasal speculum, then, starting the motor by pressure of my foot upon the electric button, with a single sweep of the drill to sever the desired *point d'appui*.

An antiseptic crown-drill (Fig. 13) propelled by the electric motor has, in my hands, proved a very useful device for cutting away septal obstructions.

A steel knife-blade located just below the serrated margin of the drill breaks up the osseous and cartilaginous core, and the resultant detritus is eventually discharged through a window cut in the side of the instrument. It is clear that this device enables one to obtain the advantages of the

FIG. 13.



Author's trephine crown-drill.

FIG. 14.



Author's antiseptic crown-drill.

anterior action of the trephine without the objectionable features possessed by Dr. Curtis's instrument, due to the retention of the excised core within the nostril or the drill itself.

I have recently modified and improved this drill by simply surrounding the cutting facets by a knife-like ring, the edge of which may be either interrupted or unbroken, thus approximating more exactly the true type

of crown-drills. (Fig. 14.) The simplicity and reduced size of this device obviously facilitate its manipulation in a narrow nostril and render thorough cleansing easier, without sacrificing any of the advantages of the first-mentioned drill. In the tubular scissors or nasal plane (Fig. 15) I have utilized a cutting device which has already been employed on other

FIG. 15.



HAZARD, HAZARD, & CO. W.F. FORD.

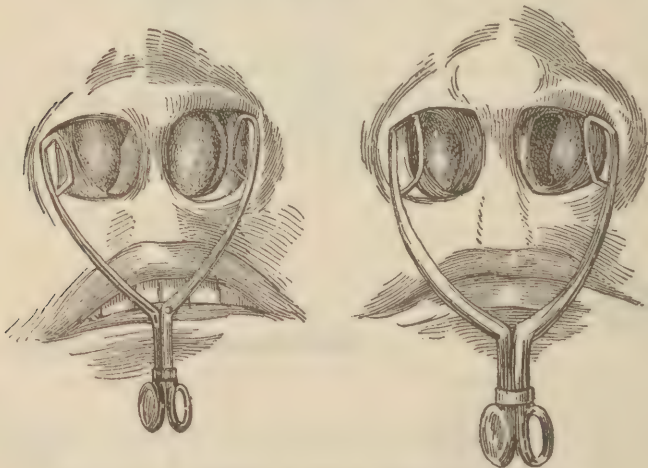
Author's scissor tubular-drill.

parts of the body in various forms and for different purposes. It consists of a small cylinder within which rotates a delicate tube, the end of which can be discerned through the fenestra as shown in the figure. The inner tube, it will be observed, is set with a row of fine teeth. These teeth may be dispensed with.

A useful feature of these drills will be recognized in the property they possess of removing bone and cartilage of the deflected septum without injury to the overlying mucous membrane. It is obvious that the preservation of the pituitary membrane in its entirety and integrity affords protection to the wound and hastens the restoration of the injured tissues to their proper functions. It will be often found convenient to separate the mucous membrane and temporarily secure it to the roof of the nostril by means of cotton pledgets before cutting away the subjacent bone or cartilage.

The tubular scissors or nasal plane I find particularly useful for levelling

FIG. 16.



Author's case of deflection of septum, before and after operation.

any slight irregularities left after the use of either of the foregoing drills, and I believe that the finishing touches imparted by it in this mode of procedure conduce to more rapid healing and better results. (Fig. 16.) The

rules for the use of cocaine and the hæmostatic clamp apply, of course, with equal force in this class of operations upon the septum.

Stellate Punch Procedure.—Although this, in the majority of instances, can be accomplished without perforating the septum narium or weakening the nasal supports, it is obvious that a certain class of cases, usually those presenting an extreme degree of deflection, may be followed by the above-

FIG. 17.



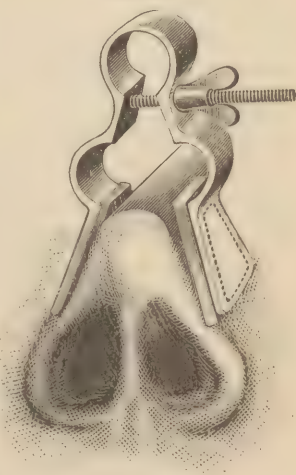
Author's modified Steele's stellate septum-punch.

mentioned undesirable consequences. I have therefore occasionally made it a rule to resort to a different method in this class of cases. It consists in the employment of a modification of Steele's stellate punch (Fig. 17) in conjunction with a peculiar nasal clamp or splint. The modification consists of a change in the form of the socket which permits the blades to be introduced singly and perfectly parallel with each other and at the same time securely jointed, and the excavation of the centre of the stellate knife, thereby avoiding the occurrence of sloughing from excessive mutilation, with consequent button-holing of the septum,—a common accident apparently ignored by certain operators.

Another difficulty rests in the proper approximation of the divided fragments, and just at this stage the bad results show themselves. While observing the behavior of a case operated upon and afterwards treated by the usual method (the nasal plug), I was convinced that just here the trouble arose. A hard foreign body within the nostril may produce intense irritation, profuse rhinorrhœa, high fever, and inflammation. Why, then, should we expect other than unfavorable results from the practice of this method? The

nasal clamp-splint (Fig. 18) has, in my practice, relegated these inconveniences to the history of the past. The septum, made sufficiently plastic by means of the punch, is simply held in place by a slight pressure exercised over the cutaneous surfaces of the *alæ nasi*. No hard foreign

FIG. 18.



Nasal clamp-splint.

substances disturb the equilibrium of the inner nares, and therefore the above undesirable consequences are avoided. The pressure of the splint can be nicely regulated by the patient by means of a delicate screw. Any tendency to loosen may be easily overcome by affixing adhesive plaster to the pressure-pads and then sticking it to the skin. It is sometimes desirable to employ soft intra-nasal antiseptic plugs in conjunction with this clamp.

NEOPLASMS.

The more common forms of nasal neoplasms calling for surgical interference are myxomata, myxo-fibromata, and adenoid enlargements in the naso-pharynx. These growths are notably benign in character.

Of more infrequent occurrence, yet usually benign in character, may be enumerated fibromata, papillomata, adenomata, angiomas, osteomas.

Of the malignant neoplasms, in order of frequency occur sarcomata and carcinomata. There may, in some instances, exist an intermingling of benign and malignant elements, as in cases of angio-sarcoma, lympho-sarcoma, etc.

BENIGN NEOPLASMS.

Myxomata.—*Historical and Critical.*—Prominent among the methods employed for the surgical treatment of nasal myxomata or gelatinous polypi may be noticed injection, galvano-cautery, galvano-puncture, and the more strictly surgical measures of evulsion, abscission, and écrasement.

Evulsion was first recommended by Hippocrates,¹ who employed a sponge for this purpose. It has been practised in more modern times by McKuer² and Voltolini.³ The finger-nail has been employed by some operators to carry out the same plan of treatment (Sabatier⁴). The forceps, through the endorsement of the late Dr. Gross,⁵ was rendered quite popular among a certain class of operators in this country, and has been advocated abroad by Erichsen⁶ and Albert.⁷

Zaufal's criticism⁸ that it is "a barbarous operation, unworthy of modern surgery," though apparently severe, has been shown to be appropriate by the researches of Michel⁹ and Leméré.¹⁰

The practice of injecting caustic compounds has been recommended by Donaldson,¹¹ who employed chromic acid carried into the substance of the growth by means of a pointed glass rod.

¹ Mackenzie, Diseases of the Nose.

² Holmes, System of Surgery, 1862.

³ Monatsschrift für Ohrenheilkunde, 1882.

⁴ Médecine opératoire, 1824.

⁵ System of Surgery, 1882.

⁶ Science and Art of Surgery, 1860.

⁷ Lehrbuch der Chirurgie, 1881.

⁸ Die allgemeine Anwendbarkeit der kalten Drahtschlinge, 1878.

⁹ Die Krankheiten der Nasenhöhle, 1876.

¹⁰ Les Accidents consécutifs à l'Arrachement, etc., 1877.

¹¹ Archives of Laryngology, 1883.

Among other chemicals used for injection are found chloride of zinc (Erichsen¹), tincture of the chloride of iron (Maxwell²), nitric and acetic acids, and Vienna paste. Caustic methods are seldom employed, on account of the pain, secondary putrefaction, and great expenditure of time required by this treatment.

The electro-cautery, originally introduced by Middeldorpf,³ has been advocated by Voltolini,⁴ M. Mackenzie,⁵ *et alii*. It is open to the objection of being a needlessly complicated and tedious procedure for the removal of conditions amenable to much simpler and speedier methods of treatment. The same criticism may be applied with still greater force to the procedures of electrolysis and galvano-puncture.

The method of abscission has been employed by a number of prominent surgeons by means of various mechanical devices, conspicuous among which are M. Mackenzie's⁶ nasal forceps, Woakes's⁷ scissors, Cant's grape-scissors, and snaring devices of Robertson,⁸ Hilton,⁹ *et alii*.

The scissor devices have never become popular, by reason of the profuse hemorrhage occasioned by their action; the snaring process, though provocative of less hemorrhage and consequently insuring greater precision, has been almost entirely superseded by the more accurate and bloodless method of *écrasement*. The employment of the *écraseur* for the removal of nasal myxomata was first urged by me in 1880. My method and instrument in its entirety or in its modified form is advocated by Bosworth,⁹ Robinson,¹⁰ M. Mackenzie,¹¹ Delavan,¹² Jurist, Woakes,¹³ Schech,¹⁴ *et alii*.

Stated in general terms, I think it will be conceded that the treatment of myxomata must have for its object not merely the removal of the growth, but also the eradication of its base, the stalk of the polypus, and the removal of its apparent cause, the offending septal deformity. The first indication is always imperative; the last-mentioned course must depend upon the exigencies of the case, the character of the polypus, and the extent of the deflection. In my experience nothing has accomplished the eradication of the base of the polypus with such satisfaction and certainty as the cold steel wire in a canulated *écraseur*, reinforced by my *rongeur* forceps and nasal punch.

¹ Science and Art of Surgery, 6th edition.

² Medical Record, 1868.

³ Die Galvano-Kaustik, 1854.

⁴ Ibid., 1867.

⁵ Diseases of the Nose, 1884.

⁶ M. Mackenzie, *op. cit.* 6.

⁷ Robinson, Nasal Catarrh, 1885.

⁸ Edinburgh Medical and Surgical Journal, 1805.

⁹ *Op. cit.*

¹⁰ Nasal Catarrh, 1885.

¹¹ Diseases of Throat and Nose, 1884.

¹² Cyclopædia of the Diseases of Children, 1889.

¹³ Nasal Polypus, 1887.

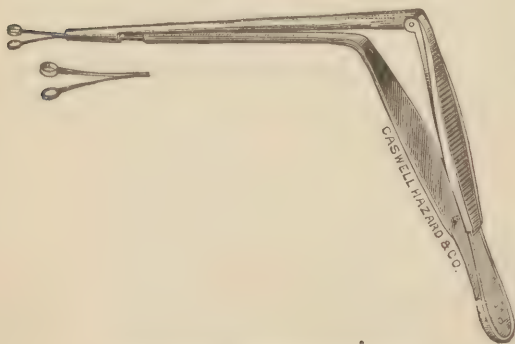
¹⁴ Die Krankheiten der Mundhöhle, des Rachens und der Nase. Eng. Trans., 1886.

Monogenetic (single-root) myxomata (Fig. 19) require the employment of the snare alone; polygenetic (many-rooted) myxomata may call for the combined use of both snare and punch.

Inasmuch as the principle and construction of my écraseur have already been noted, it will be necessary only to briefly explain its action upon the polypus. Fig. 2 exhibits the polypus snare. All that is required is that the loop, properly arranged in shape and size in accordance with the dimensions and location of the myxoma, be inserted over the polyp's point of greatest curvature, and simple traction accomplishes the rest, for the steel loop with each turn of the traction-bar advances steadily towards the base of the pear-shaped mass, not stopping till it reaches the very point of the growth's attachment to the mucous membrane or bone itself, which it often tears away along with the polypus.

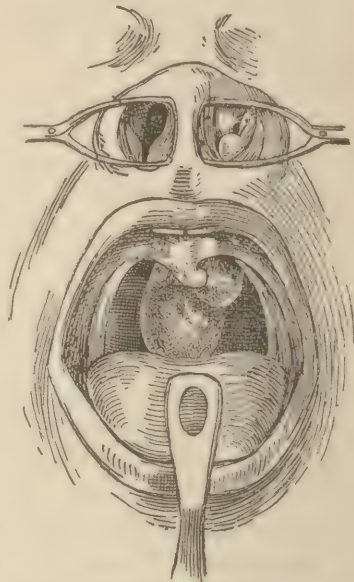
Myxomata, varying in size from that of a millet-seed to that of an oyster, can with equal efficiency be grasped and removed by this accommodating little instrument. Much patience, however, must be exercised in the eradication of the diminutive polypi. In order to facilitate this procedure, I have frequently employed, in conjunction with the écraseur, the delicate scissor-punch (Fig. 20), which effectually grasps and divides the clusters of diminutive polypi lying in the almost inaccessible recesses of the superior meatus.

FIG. 20.



Author's small spring scissor-punch.

FIG. 19.



A monogenetic nasal myxoma associated with deflection of the septum. The neoplasm could be partly swallowed by the patient, a young man. It was removed *en masse* by means of author's écraseur.

Several sizes and forms of this little instrument can be obtained, the smallest of which is not much wider than the lead of an ordinary pencil.

This device, therefore, acts as a veritable searcher, seeking out the embryonic or glistening bead-like masses and cutting and

dragging them from their basic attachment together with the mucous membrane which ushered them into life and maintained their growth.

As might naturally be inferred, the hemorrhage resulting from the cuts made by this instrument is insignificant, evidently for the reason that, like the action of the *écraseur* wire, that of the scissor-punch is crushing in its effect.

Adenoids.—The surgical treatment of adenoid growths in the post-nasal vault permits a large latitude in the character of the instrumental interference on account of their markedly glandular and consequently slightly hemorrhagic nature. Consequently, we find a number of cutting and tearing devices recommended and employed for this purpose.

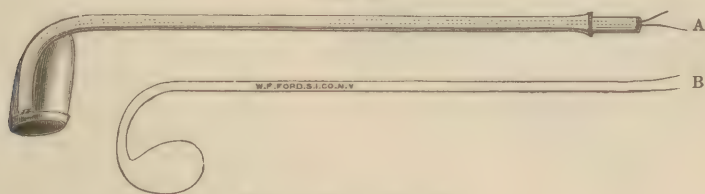
These growths may be removed through the anterior nares, or, preferably, through the mouth and naso-pharynx. Reduction in the size of these obstructions has been accomplished by means of caustics, chromic acid, nitrate of silver (Löwenberg), and electric cautery (B. Robinson).

Chemical caustics are contra-indicated by reason of the difficulty in limiting their action, and the electro-cautery because of its tardy action.

Of the more strictly surgical procedures, the use of the finger-nail and that of the artificial steel nail of Capart and L. Browne are good examples of the simplest measures. Next in order of simplicity come ring-knives (Meyer and Störk), blunt and sharp curettes (Bosworth and Mackenzie); also knife and tearing-forceps (Major, Gradle, Cohen, Löwenberg, and Hooper). Whilst it is quite possible to seize and remove larger masses of these growths through the naso-pharynx by means of these various cutting and tearing devices, their employment may be and has been followed by serious hemorrhage (J. Wright) on account of the difficulty or impossibility of seizing the soft glandular structures without lacerating the firmer and more vascular basic tissues.

The practice of *écrasement* for the removal of these growths (Bosworth and Robinson) affords a perfectly safe, comparatively bloodless, and efficient method for excising adenoid enlargements in the vault of the pharynx. This may be accomplished through the anterior nares by introducing a reduced wire loop and playing out the wire when it reaches the naso-pharynx, or, still better, through the mouth by means of my cup canula (Fig. 21 A), or the bent canula of my *écraseur*, as suggested by Dr. Bosworth (Fig. 21 B).

FIG. 21.



Écraseur tips for adenoids.

Angiomata.—Angiomata, though of infrequent occurrence, demand recognition on account of the manner in which they have been known to resent ordinary surgical interference, profuse and even fatal hemorrhage having been reported to have resulted from their incautious excision. Pure pulsating angiomata should be distinguished from growths possessing angio-

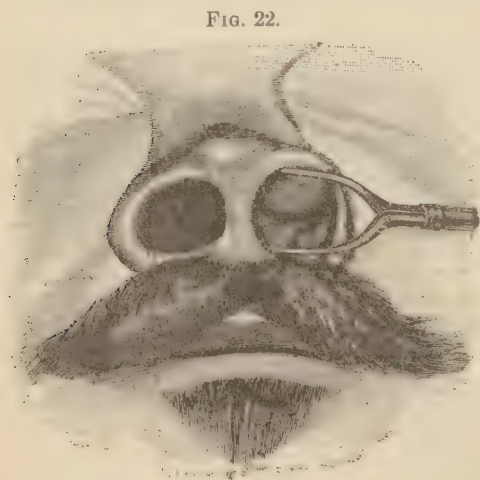
matous features,—*e.g.*, telangiectatic polypus or angio-sarcoma. (Fig. 23.) Of the surgical measures adopted for their removal, external excision has proved fatal, the galvano-cautery uncertain, and interstitial injections of caustics extremely dangerous.

It has been conclusively shown that the cold-wire *écraseur* is the instrument best adapted for the removal of these growths.¹ It is obvious that, on account of the great vascularity possessed by these neoplasms, great care must be exercised to accomplish their successful and safe removal. Of paramount importance is the practice of slow traction, to secure firm clotting before permitting final division of the tumor. Sometimes the vascularity is so excessive that the greatest manipulative delicacy must be exercised in the adjustment of the wire loop, since even the momentary contact of the wire or instrument against the tumor may prove sufficient to cause profuse hemorrhage. It is safer to permit the excised tissues to remain undisturbed in the nostril for from twenty-four to forty-eight hours. Immediately after the adjustment of the wire loop around the growth it is sometimes advisable to pack the nostril hermetically with styptic cotton. The employment of *écrasement* with the cold wire, whenever possible, has invariably yielded excellent results in my hands. Even partial excision of these neoplasms is likely to be followed by their almost complete disappearance through post-operative shrinkage.

Fig. 22 may serve to convey an idea of the appearance of these tumors. The patient, a negro, had suffered from the growth for more than seven

years. The dimensions of this very vascular angioma were three by two by one and a half inches. Marked displacement of the osseous nasal framework had resulted from the great and prolonged intra-nasal pressure. The tumor was entirely eradicated by means of my *écraseur*.

The rules just enunciated for the surgical treatment of non-malignant neoplasms apply with equal or slightly modified degree to that of the other forms already enumerated. Any variation that may exist in the management of these principally



Cavernous angioma (author's case).

applies to that of fibromata and myxo-fibromata, and largely consists in the utilization of wire-placing devices to secure these tumors properly within the wire loop.

¹ Roe, Archives of Laryngology, 1892; Bosworth, Diseases of the Nose and Throat, 1889; Jarvis, International Journal of Surgery, 1888.

MALIGNANT NEOPLASMS.

Of the malignant neoplasms, the sarcoma is more frequently found than the carcinoma. It is usually non-hemorrhagic in character, but may possess angiomatous features. The last-named attribute renders treatment both difficult and dangerous. Unlike pure angiomata, there is apt to be an increase rather than a decrease in the dimensions of the mass when considerable time has been allowed to elapse after its partial removal. The cold or hot wire is preferably employed in the treatment of these growths. Choice should be given to the cold over the incandescence wire.

The pain resulting from the excision of sarcomata is not apt to prove severe, nor the hemorrhage great. They may be, consequently, excised with ease and rapidity by using the cold-wire *écraseur*, and in fact more speedily than they can reform. When the base of the tumor has been reached and levelled, it may prove advisable to cauterize the root-structures with chromic acid to retard repullulation.

The main difficulty lies in the adjustment of the wire loop about the neoplasm. The adoption of any one of the methods available for this purpose will depend upon the location and size of the neoplasm.

Occasionally the combined practice of intra-nasal and extra-nasal surgery may be rendered necessary by reason of the extension of the growths into the accessory nasal fossæ.

Fig. 23, taken from a photograph, exhibits a patient from whom I removed a quantity of sarcomatous tissue and who was eventually cured by an external operation performed by Dr. Joseph Bryant. The operation consisted in the ligation of both common carotids and the subsequent exsection of a portion of the left superior maxilla. As a counterpart to this good result might be instanced a case of the kind now being treated by me upon strictly intra-nasal principles, in which partial excision of the upper jaw has been followed by a regrowth of the tumor. That it is possible to attain a favorable result through the employment of intra-nasal measures has been satisfactorily demonstrated by the history of a case of round-cell sarcoma of the vault of the pharynx, reported by Dr. Bosworth as cured by the use of my nasal *écraseur*.¹

Carcinoma of the nasal passage is less frequently met with than sarcomatous disease.

The surgical treatment of this condition and that of sarcoma are identical.

FIG. 23.



Dr. Joseph Bryant's and the author's case of sarcoma; a portion of the superior maxilla removed.

¹ Medical Record, 1885.

The tendency to return is probably greater than that usually manifested by sarcomata, but when subjected to surgical interference they exhibit slighter vascularity and less sensitiveness.

MISCELLANEOUS CONDITIONS.

Nasal Caries.—Conspicuous among the miscellaneous conditions requiring surgical treatment stands nasal caries.

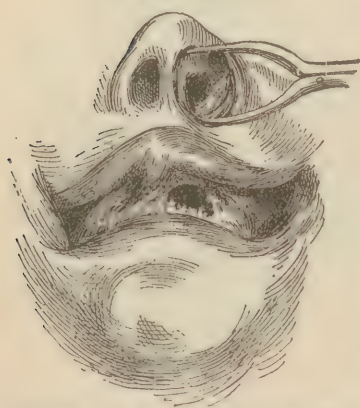
Necrosis of the osseous structures of the nose may occur as a result of syphilitic disease, and also from scrofula, traumatism, and inflammatory abscess in the accessory sinuses. This condition is most frequently met with as one of the tertiary manifestations of syphilitic disease, and consequently is especially amenable to surgical treatment.

In the event of a sequestrum having formed, the necrotic mass may be seized and removed by the forceps. Firm carious formations may be sometimes loosened *en masse* by judicious manipulation, or they may be scraped away by means of the curette. In the event of these means being without avail, recourse must be had to the surgical drill. Small revolving burrs afford the speediest and safest means for the accomplishment of this object.

Care must be taken never to lose sight of the drill. Cutting must be continued until the friable necrosed bone is replaced by a firm vascular base. The detritus should be frequently swept away by means of coarse sprays and detergent douches, to facilitate inspection. Healing of the surgical wounds should be hastened by the employment of appropriate topical applications, —iodoform, vaseline, etc.,—used in conjunction with constitutional specific medication, large or increasing doses of iodide of potassium, and the like.

Fig. 24 exhibits an example of extensive syphilitic caries which involved almost the entire nasal cavity and a portion of the superior maxilla. Meningitis resulted in this case, as in Trousseau's fatal one, from extension of the nasal disease into the cranial cavity. Treatment of the patient in accordance with the rules just enumerated resulted in the complete cure of the syphilitic disease.¹ A necrosed inferior turbinated bone and perforated osseous septum may be observed in the figure within the left nostril, also a small post-operative opening through the alveolar border connecting the nose with the mouth.

FIG. 24.



Author's case of syphilitic caries of the nose and mouth.

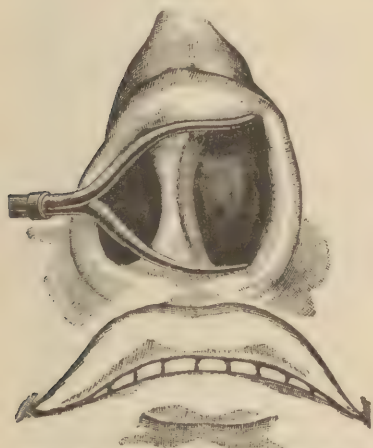
The rules laid down for the treatment of syphilitic nasal caries apply, with the slight modifications due to situation and circumstance, to the surgical management of the other forms of this condition.

¹ Notes on a Case of Nasal Caries, Medical Register, February 2, 1889.

Congenital Nasal Atresia.—Congenital atresia of the nasal passages, though of comparatively infrequent occurrence, is a noteworthy condition by reason of the excellent results obtainable through surgical treatment. It may exist in the form of an anterior stenosis, posterior occlusion, or general obliteration of the nasal chambers.¹ All of these varieties have come under my notice. The surgical drill cutting both forward and laterally (crown-drill and burr) affords by far the most efficient means for restoring the patency of the congenitally sealed nostrils.

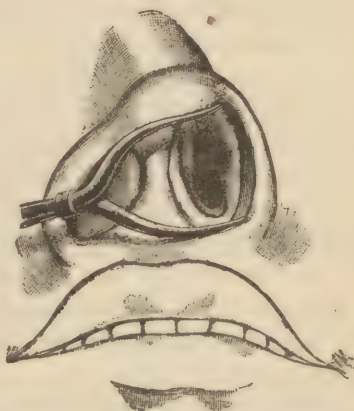
It may be necessary to divide membrane, plates of bone, or altered turbinated structures. Figs. 25 and 26 exhibit a case of anterior congenital

FIG. 25.



Author's case of congenital nasal atresia,
before operation.

FIG. 26.



Author's case of congenital nasal atresia,
after operation.

atresia before and after operation. The patient, a lad of nineteen years, was unable to use the nostril on account of the obstructive presence of a web of dense fibrous tissue which converted the nasal vestibule into a cup-shaped depression. Normal nasal respiration was restored by perforating the fibrous membrane by means of the surgical drill, as just explained, or more elaborately noted in the division devoted to deformities of the septum.

Fracture of the nose, as commonly met with, may be treated in accordance with the mechanical principles already indicated for the surgical management of the common deformity, displacement of the septum.

Hematoma, abscess and perforation of the septum require no surgical treatment worthy of special notice.

Irregularity (asymmetry) of the turbinated bones and turbinated osseous shells may be removed by means of the wire *écraseur* in the same manner as explained for the removal of hypertrophied turbinated tissues, or, where special indications exist, by the employment of the surgical drill.

¹ Two Unique Cases of Congenital Occlusion of the Anterior Nares, New York Medical Journal, November 2, 1887.

HAY-FEVER.

BY FRANCKE H. BOSWORTH, M.D.,

Professor of Throat Diseases in Bellevue Hospital Medical College, New York.

THIS is a generic expression which we use as covering all those affections of the nasal mucous membrane which are characterized by profuse watery discharges, with turgescence of the mucous membrane, not dependent upon inflammatory action, but rather upon a vaso-motor paresis of the blood-vessels which constitute the turbinated bodies. This vaso-motor control being abolished, the blood-vessels are dilated to such an extent that the serum escapes and pours through the mucous membrane into the nasal cavity, giving rise to nasal stenosis and intense irritation with formication.

This term is generally used to designate that periodical form of the disease which occurs only during the autumnal months, in contradistinction to the vernal fevers or rose-colds which occur in the early portion of the summer. It has received, however, such universal adoption, as covering all the forms of the periodical influenzas, that we use it here in its more generic sense.

Definition.—We may define hay-fever, then, as an affection which is characterized by recurrent annual attacks of a more or less severe type of influenza, in which the mucous membrane of the nasal cavity becomes swollen and turgescient and pours out a large amount of watery serum, which in traversing the mucous membrane gives rise to intense irritation with formication.

It recurs and terminates each year at fixed periods in the same individual, although the periods of invasion vary greatly in different individuals. I believe it to be entirely dependent upon the presence in the atmosphere of the pollen of some one of the flowering plants. Moreover, different individuals are susceptible to the action of different pollens, which will explain the fact of the varying periodicity of the disease in individual cases.

History.—The affection was first recognized by John Bostock,¹ who suffered from the disease in his own person, although before his time instances had been observed by Botallus,² Van Helmont,³ Binningerus,⁴ and others.

¹ Medico-Chirurgical Transactions, vol. v. p. 161, 1819.

² Commentarioli duo, alter de Medici, alter de Aegroti Munere, Lugduni, 1565, p. 23.

³ Asthma et Tussis, cap. x., Opera omnia, p. 344, Hafniæ, 1707.

⁴ Obs. et Curat. Medicinæ Centuriæ quinquæ, Cent. secundo, Obs. lxxxvi.

Bostock, however, first recognized its periodicity, and gave an excellent description of the disease. He objected to the term "hay-fever," which already in his day had crept into use, owing to the fact that the attack in some instances seemed to have been brought on by the emanations of hay, contending that moist heat, sunshine, and dust were the prominent factors in exciting the exacerbation. Subsequently, Gordon¹ deduced, from a careful study of his cases, the fact that the cause of the attacks was to be found in the emanations from flowering grasses, especially the *Anthoxanthum odoratum*, or sweet-scented vernal grass. In 1854, Phoebus made a collation of one hundred and fifty-four cases, from the study of which he seems to have reached the conclusion that sunlight was the active cause of the attacks. Still later we find Helmholtz detailing to Binz,² by letter, the history of his own sufferings from the disease, propounding the theory that the attacks were caused by certain vegetable spores which he discovered in the mucous discharge from his own nose. Curiously enough, the solutions of quinine which Helmholtz seems to have used successfully in his own case became an exceedingly popular and somewhat efficient remedy until his theory of vegetable spores was completely disproved by the remarkable series of experiments which were performed by Blackley,³ who demonstrated beyond question that the impact of the pollen of flowering plants on the mucous membrane of the upper air-tract was the true source of the symptoms which characterize an exacerbation of hay-fever.

No account of this disease would be complete without reference, at least, to the admirable monographs of Wyman⁴ and Beard,⁵ as also that of Marsh,⁶ who first called special attention to the activity of the pollen of *Ambrosia artemisiæfolia*, or common rag-weed, which prevails so extensively through the United States, and which is probably by far the most active of the pollens in America in producing the attacks. In 1882 a notable addition to our knowledge of the affection was made by Daly,⁷ who first called attention to a fact which I think has been since conclusively demonstrated, that in a diseased condition of the nasal cavities might be found an important factor in the production of the exacerbations of this disease.

Etiology.—We find that the earlier investigators practically confined themselves to the study of the exacerbations, and various theories were broached until Bostock clearly demonstrated the activity of pollen in producing the attacks. In Beard's investigations a new line of departure seems to have been taken, in that his deduction, which was based on an analysis of over two hundred cases, was that the disease was essentially

¹ London Medical Gazette, vol. iv., 1829.

² Virchow's Archiv, February, 1869, p. 100.

³ Hay-Fever, London, 1873.

⁴ Autumnal Catarrh, New York, 1876.

⁵ Hay-Fever or Summer Catarrh, New York, 1876.

⁶ Transactions of the Medical Society of the State of New Jersey, 1877.

⁷ Archives of Laryngology, vol. iii. No. 2, p. 157.

a neurosis. His conclusion, I think, cannot be questioned. Daly's further suggestion of a local morbid lesion in the nose adds a third factor to the causation of the disease. We thus find that there are three conditions necessary for the production of an attack of hay-fever: *first*, the presence of pollen in the atmosphere, as demonstrated by Blackley; *second*, the neurotic habit, as shown by Beard; and *third*, a local morbid condition of the nasal mucous membrane, as proved by Daly. I think this view must be accepted. Certainly my own experience, which has been a somewhat large one, warrants me in the belief that these three conditions are present in all cases, and that no individual in whom one or more of these conditions is absent is susceptible to an exacerbation of hay-fever; the first condition being the exciting cause of the exacerbation, while the other two are to be regarded as actively predisposing causes.

The Presence of Pollen in the Atmosphere.—The pollen theory of hay-fever is a very old one, but we find its advocates failing to make a distinction between the cause of the exacerbations and the peculiar systemic habit which renders individuals susceptible to the action of pollens. Of course, when we have established beyond question that the pollens of flowering plants are responsible for the peculiar symptoms which attend the disease, we have only determined the exciting cause of the exacerbations, without having arrived at any knowledge of the primary cause of the disease itself. That the exacerbations are excited by the presence of pollen in the atmosphere cannot be questioned, in view of the admirable series of experiments which were made by Blackley,¹ extending through a series of years from 1866 to 1878. These experiments were not only ingenious in their details, but so thoroughly conclusive that it seems wise in this connection to give a brief *résumé* of the plan which Blackley pursued. As before stated, he was a sufferer from hay-fever: his annual attack came on about the 10th of June and usually terminated the 1st of August. The apparatus from which he obtained the most satisfactory results in his investigations consisted of a vertical plate of glass seven-eighths of an inch in diameter, which was covered by a hood and pivoted to an upright staff. Surmounting the hood was a weather-vane, the object of which was to direct the face of the glass plate towards the prevailing wind-current. To the face of the glass plate there was affixed a microscope cover-glass one centimetre in diameter, which was covered with glycerin. In this manner any pollen which was floating in the atmosphere would be blown directly upon the plate by the wind-current, and adhere to the small slide prepared with glycerin. Blackley observed that from the last of May to the 7th of June the atmosphere contained pollen in small but increasing quantities: thus, on the 30th of May he was enabled to count twenty-five grains on his small disk, and at this time he commenced to suffer in his own person with a slight sense of irritation in the nasal mucous membrane.

¹ Op. cit.

From this time on the number of grains increased, until on the 8th of June he was able to count seventy-six grains upon the slide. On the 10th of June the number had increased to over two hundred and eighty, and at this time his catarrhal symptoms had increased to such an extent that he considered his annual visitation as having fully developed. Continuing his investigations, he found the number of pollen grains varying greatly according to certain atmospheric conditions, the largest number which he counted being on the 28th of June, when there were present eight hundred and eighty grains. He furthermore noticed that on a bright, sunny, dry day the atmosphere contained large quantities of pollen, whereas on rainy days the number of pollen grains deposited upon the glass plate was notably diminished, and that passing showers made but little difference, whereas a rain continuing through twenty-four hours resulted in a very notable decrease in the number of pollen grains, as well as an amelioration of his individual symptoms. After the 28th of June he noticed a progressive decrease in the number of pollen grains which adhered to his disk, and by the 1st of August they had completely disappeared, and at the same date he experienced complete relief from the influenza.

Of course these experiments are only conclusive with regard to Blackley's own case of hay-fever; but he also made a number of investigations with regard to the annual attacks in other individuals, clearly establishing, I think, that the pollen of flowering plants is to be regarded as the active exciting cause of the exacerbations.

Why the germinal principle of flowering plants should have this peculiar action in producing vascular dilatation in the nasal mucous membrane of certain individuals is rather curious. No explanation can be offered: we can only liken its action to that of cocaine, the single drug in our Pharmacopœia which possesses the remarkable property of producing vascular contraction. Both these facts are simply established by clinical observation. Thus, Blackley has clearly shown that a condition of the atmosphere which will deposit twenty-five grains of pollen upon a disk one centimetre in diameter in the course of twenty-four hours is practically innocuous to mucous membranes: increase the amount of pollen in the atmosphere until it deposits seventy-five grains in the course of twenty-four hours, and we have a condition which is irritating to the mucous membrane in certain individuals. When, however, the atmospheric condition is such that two hundred and eighty grains of pollen are deposited upon this disk in twenty-four hours, the result is that when certain individuals inhale such an atmosphere through the nose, complete vascular dilatation ensues by the direct action of the pollen upon the mucous membrane.

In exactly the same way a two-per-cent. solution of cocaine applied to this membrane produces such complete vascular contraction that the membrane becomes thoroughly exsanguinated in about fourteen minutes; increase the strength of the cocaine to a twenty-per-cent. solution, and the

same phenomenon results in about four minutes. Here, also, there is a notable variation as regards individuals: although many are exempt from the action of pollens, none, as far as I know, are ever entirely exempt from this action of cocaine.

We have spoken of pollen in general, without referring to any of the different varieties. As a matter of fact, in individuals possessing this peculiar susceptibility, the pollen of all flowering plants is to a certain extent active, but it varies notably in different plants. Those which we regard as especially active are the different varieties of meadow-grass, sweet-scented vernal grass, meadow-foxtail, golden-rod, etc. Indeed, Blackley in his experiments recognized these pollens as constituting from ninety to ninety-five per cent. of all those which he counted on his disks. In addition to these, the pollen of roses, as well as of the cereals, wheat, rye, oats, Indian corn, etc., is known to be active in the production of the attacks. In America the rag-weed is probably the most active source of the disease in its autumnal form, which is the prevailing type met with in this country.

The patients occasionally complain that their symptoms are excited by various fruits, such as peaches, pears, plums, as well as the flowers and stalks of different vegetables. This is probably due to the fact that some one of the anemophilous pollens have found a lodgement upon their surface, rather than that there are any irritating emanations from these fruits or vegetables themselves.

The Neurotic Habit.—The underlying systemic condition which renders individuals susceptible to the disease is undoubtedly neurotic. This has been very conclusively shown by Beard, who collated over two hundred cases by a somewhat extensive correspondence, and established the fact in the majority of the cases that the prevailing family tendency was in the direction of nervous affections, such as chorea, epilepsy, asthma, and other kindred disorders. Furthermore, it is a matter of constant observation that the disease runs in families.

What the essential pathological lesion is which constitutes neurosis, in the very nature of the question is one difficult to determine. I am disposed to think, however, that if there is any pathological lesion in these cases it is found in the peculiar lack of vaso-motor control which characterizes the neurotic manifestations; thus, what in former days was called spinal irritation was due probably to a vaso-motor paresis of the blood-vessels of the spinal cord. In asthma the essential lesion is unquestionably a vaso-motor paresis of the blood-vessels of the bronchial mucous membrane, while in hay-fever the condition is due to a vaso-motor paresis of the blood-vessels of the nasal mucous membrane.

The Local Morbid Condition of the Nasal Passages.—As before stated, this feature of hay-fever was first brought prominently to our attention by Daly,¹ who reported cases which had been cured by treatment confined

¹ Loc. cit.

entirely to the correction of the diseased condition of the intra-nasal mucous membrane. A clinical fact was thus established which has been verified in such a large number of cases since as to compel our acceptance of the view that certainly in the very large majority of cases, and probably in all, a predisposing cause of the attack lies in a previously existing morbid condition of intra-nasal tissues. This, furthermore, must be one of an obstructive character, which tends to produce in itself vascular dilatation.

I have never seen a case of hay-fever occur in connection with an atrophic rhinitis or syphilitic disease of the nose which has resulted in destruction of tissue whereby the lumen of the passages was abnormally increased. In all cases which have come under my own observation the lesion has been obstructive in character.

The method of its action is to a certain extent mechanical and easily appreciated. An obstructive lesion in the anterior portion of the nasal passages necessarily gives rise to a rarefaction of air immediately behind the point of stenosis with every act of inspiration. The immediate result of this perhaps is not apparent, but if long continued there ensues a somewhat permanent dilatation of the blood-vessels, which is especially marked in the large venous sinuses which are found on the faces of the lower and middle turbinated bones,—namely, the turbinated bodies. This results in a permanent turgescence of the mucous membrane, whereby hyper-nutrition is established, and ultimately a true connective-tissue hypertrophy in the mucous membrane proper. This gives rise in ordinary cases simply to a hypertrophic rhinitis. In a patient of a neurotic habit—namely, one in whom vaso-motor control is somewhat weakened—the result is likely to be that the impact of a pollen-laden atmosphere on such a membrane will give rise to symptoms which constitute the exacerbation of hay-fever; certainly the conditions are established which favor the development of this disease.

Nasal polypi are occasionally said to be active in the causation of this affection. This may be true in certain cases: I think, however, that in most instances the polyps are rather the direct result of the hay-fever; the essential feature of this latter disease being, that enormous quantities of serum escape from the blood-vessels and pour through the mucous membrane, especially of the upper portion of the nasal passages, whereby it becomes sodden, or water-soaked, as it were, and in this way myxomatous degeneration develops, which eventually assumes the form of small pedunculated polypi.

Tornwaldt,¹ in his admirable series of observations on naso-pharyngeal catarrh, takes the ground that a diseased condition in the naso-pharynx may not only give rise to symptoms simulating nasal disease, but may also be the actively predisposing cause of asthma and hay-fever, in the same manner as a diseased condition of the nasal mucous membrane. I fully agree with the observation as far as the question of hay-fever is concerned.

¹ Ueber die Bedeutung der Bursa pharyngea, Wiesbaden, 1885.

In just what manner this operates I am unable to express a definite opinion; but basing my conclusions purely on clinical observation, I am fully of the opinion that a catarrhal condition of the mucous membrane lining the naso-pharynx should be reckoned among the possible local lesions in the upper air-tract which predispose to a periodical influenza.

Among the curious features of hay-fever we should note the peculiar psychic influence, which acts occasionally to precipitate an exacerbation. It is only in this way that we can explain such remarkable instances as John N. Mackenzie reports,¹ in which an attack of rose-cold was brought on by means of an artificial rose. Morell Mackenzie also reports an instance in which a patient was seized with an attack of hay-fever by gazing upon a picture of a hay-field. Patients often state that their annual attack occurs each year upon a fixed date. Now, it is impossible, with the varying character of our seasons in this country, that the plant which generates the pollen which is the exciting cause of the attack in these individuals should flower at exactly the same date each year. We can only explain these cases, then, by the peculiar state of anticipation which is established in the minds of these patients, by which they expect their attack on this fixed date, and which therefore serves to precipitate it, even though but a small amount of the pollen be present in the atmosphere at the time. This condition of mental anticipation is well illustrated in those cases of intermittent fever in which the chill occurs each alternate day at a given hour. It is not infrequently a successful experiment to turn back the clock for two or three hours, and in this manner postpone the chill by the same length of time.

Phoebus, as we have seen, after a most elaborate investigation of the subject, arrived at the conclusion that sunlight was an active cause in producing the exacerbation. In the light of Blackley's experiments this error is easily explained by the fact that a hot, dry day is especially favorable for the dissemination of pollen, whereas rainy weather, while interfering with its dissemination, favors its development. In this way it becomes especially active where a hot, dry period follows immediately upon stormy weather.

The minute organisms which Helmholtz's microscope revealed to him as permeating the discharges from his nose during an attack of hay-fever were probably fragments of the mycelium-like threads which develop from the pollen cells under the influence of the heat and moisture of the nasal secretions, and which contained the minute fovilla of the pollen cells.

The relief obtained by the quinine solution (a remedy which became so popular immediately after his investigations were published) must be attributed to psychical influence.

The age at which the disease develops is usually in the earlier decades of life: thus, in the series of eighty cases observed by the writer,² there

¹ American Journal of the Medical Sciences, January, 1886.

² Diseases of the Nose and Throat, vol. i. p. 208, New York, 1889.

occurred between the ages of one and ten, nine cases; between the ages of ten and twenty, twenty-seven cases; between twenty and thirty, sixteen cases; between thirty and forty, twenty-one cases; between forty and fifty, three cases; and over fifty, four cases. We thus find that the larger proportion of cases developed during the second decade of life. No age, however, seems to be exempt from its development: thus, I have seen it occur at the age of two, and have also had under treatment a patient in whom the disease first developed at the age of seventy-three. Wyman,¹ in an analysis of the seventy-two cases on which he based his observations, found the disease occurring as follows: under ten years of age, eleven cases; between ten and twenty, fifteen; between twenty and thirty, twenty-five; between thirty and forty, eight; between forty and fifty, eleven; and above fifty, two. This table differs somewhat from my own, but it should be stated that in my cases the date of the occurrence of the first attack is given, while Wyman simply reports the age of the patient at the time he came under observation.

The fact observed by all writers, that the disease belongs essentially to the better-educated classes, and is rarely met with among laboring people, only emphasizes the view already stated that it is to be classed among the neuroses. The fact that it occurs more frequently in males than in females lends weight to the statement that a catarrhal affection of the upper air-tract is to be regarded as the actively predisposing cause, since men are much more exposed to those conditions which develop catarrhal disorders than women. Of my own cases, fifty-eight occurred in males and twenty-two in females; of Wyman's cases, forty-seven were males and twenty-five females: of Beard's² two hundred cases, one hundred and thirty-three were males and sixty-seven females; while Phoebus found one hundred and fifty-four cases in males and but fifty in females.

The influence of heredity is so well known that comment is unnecessary. Sajous³ has observed cases which have developed after convalescence from one of the continued fevers or other diseases; while Leflaive⁴ and Lermoyez⁵ believed that the gouty habit exercises a predisposing influence in producing the affection.

Pathology.—The various names which are given the disease seem to suggest that the local morbid condition in the mucous membrane of the nose which characterizes the exacerbation is an inflammatory process: thus, Herzog⁶ designates it as rhinitis vaso-motoria; John Mackenzie,⁷ rhinitis vaso-motoria periodica; and others, rhinitis sympathetica, pruritic catarrh,

¹ Autumnal Catarrh, p. 97, New York, 1876.

² Op. cit., p. 43.

³ Diseases of the Nose and Throat, p. 178, Philadelphia, 1887.

⁴ Rhino-bronchite Annuelle, Paris, 1887.

⁵ Annales des Maladies de l'Oreille, March, 1888.

⁶ Allgemeine Med. Central-Zeitung, p. 1125, October 24, 1883.

⁷ New York Medical Record, July 19, 1884.

rose-cold, etc. The term rhinitis certainly is a misnomer, if by this it is intended to convey the idea that the exacerbations are characterized by an inflammatory process in the nasal mucous membrane. The first stage of an inflammation is vaso-motor paresis, but inflammatory action is not established without the subsequent occurrence of the second and third stages, in which there are rupture of the blood-vessels, escape of leucocytes, and hyper-nutritive processes in the tissues beyond. In hay-fever the essential lesion consists in vaso-motor paresis, but it remains such throughout the whole attack, there being no further development of the later stages of inflammation. The attack comes on gradually, and develops with the progressive increase of the amount of pollen in the atmosphere, and subsides with the subsidence of this atmospheric condition; but throughout its whole progress it is characterized by nothing other than simple dilatation of blood-vessels with the escape of serum.

To understand this more properly involves a brief reference to the normal physiological function of the nasal mucous membrane in respiration, for I believe that the hay-fever exacerbation has practically to do alone with the respiratory function of the nose. In health the nasal membrane pours out from twelve to sixteen ounces of watery serum daily, which is diffused over the convex faces of the turbinated bodies, for the purpose of warming, moistening, and cleansing the inspired current of air as it passes into the lungs. This process of serous exosmosis is regulated by the exercise of a vaso-motor control from certain centres in the medulla. This control furthermore is directed with an exceeding degree of nicety, in order to adjust it to the varying hygroscopic conditions of the atmosphere. The pollen of flowering plants possesses the curious property of producing practically a paralysis of this vaso-motor control in certain individuals, whereby this function of serous exosmosis is unloosened, as it were, and the membrane pours out serum with great profuseness. The pollen itself is not irritating and does not excite inflammation. It is a mistake to suppose that the pain and sense of irritation which accompany the attack are the result of the impact of an irritating substance upon the membrane. The pain, on the other hand, is the result of the pressure on the terminal filaments of the nerves exercised by this flood of serum pouring through the meshes of the membrane. This paralyzing action of pollen, then, is to be regarded as one of the peculiar properties which it possesses; moreover, this action is mainly confined to those blood-vessels which are concerned in the respiratory process,—namely, the large venous sinuses which compose the turbinated bodies. The exacerbation of hay-fever, then, consists simply in a paralysis of the respiratory function of the nose, for if we carefully examine the mucous membrane we fail to discover that the blood-vessels which circulate in the mucous membrane proper are dilated or involved in any way in this vaso-motor paresis. This is confined entirely to the turbinated bodies. We thus find that the exacerbation is due entirely to peripheral causes, and that in this way we practically eliminate the necessity

of the neurotic habit. The rôle that this latter plays in the affection is that under its influence the direct vaso-motor control which is exercised by the trigeminus and sympathetic nerves over the blood-vessels which make up the turbinated bodies is so far weakened by the systemic neurosis as to render them susceptible to the influence of pollen. This would seem to argue the possibility of there being some morbid lesion in the ganglionic centres. I do not think this necessarily follows, although the view was advocated by Kinnear,¹ who describes two conditions, one of which consists in a hyperæmia and another in an anæmic condition of the central ganglia. John Mackenzie² and Hack,³ on the other hand, seem to regard the central condition as a functional disturbance, the former describing it as a disordered functional activity of the nervous centres, while the latter regards it as a hyperæsthetic condition of the olfactory and fifth pair of nerves.

Symptomatology.—As the season approaches for the annual attack or exacerbation, the patient experiences a sense of uneasiness about the nasal passages, with a slight disposition to sneeze. As the atmosphere becomes more fully surcharged with pollen, these symptoms increase and an intense itching or formication about the upper portion of the nasal cavity becomes a prominent feature, in connection with a profuse watery discharge, which necessitates the constant use of a handkerchief, or in aggravated cases the serum drips constantly from the nose. This is usually a perfectly clear and transparent fluid at the onset of the attack, but after a few days the mucous membrane itself, with its muciparous glands, is stimulated to such an extent that an excess of mucus is poured out, which gives the secretion a grayish or cloudy appearance. The turgescence of the membrane naturally causes a more or less complete stenosis of the nasal passages, which adds notably to the discomfort of the sufferer. The vaso-motor paresis is so complete that the blood-vessels are dilated to their fullest extent, and the turbinated bodies thus form loose, flabby sacs, as it were, which completely fill the nasal passages. This condition is especially noticeable in a certain hydrostatic character which the fluid which distends the vessels manifests. Thus, it shows a tendency to collect in the most dependent portion. If the patient lies on the side, the nasal meatus which is uppermost becomes opened, while the fluids collect in the parts below, or, if the patient lies on his back, the blood flows into the posterior portion of the turbinated bodies, causing complete occlusion of the posterior meatus of each side.

After the attack has persisted for a day or so, a sharp, stinging pain, which the patient refers to the roof of the mouth, is experienced and becomes a source of no little discomfort. This is probably due to the impact of the pollen upon the mucous membrane of the upper surface of the soft palate and also of the naso-pharynx.

¹ Hay-Fever a Disease of Central Nervous Origin. New York Med. Record, p. 32, July 14, 1888.

² Loc. cit.

³ Wiener Med. Wochenschrift, 1883, No. 14.

When the attack is fully developed, the prominent symptoms consist in the profuse watery discharge, nasal stenosis, and the violent attacks of sneezing. The fluids which escape from the nose are somewhat irritating in quality, and not infrequently give rise to an irritation, or even eczema, of the muco-cutaneous junction, which may also extend to the lip. Suffusion of the eyes is a not infrequent accompaniment of the attack, and is in part the result of the sympathetic disturbance of the conjunctiva, but in the main is probably caused by the impact of the pollen upon the ocular membrane, causing vascular relaxation. In rare instances the same irritation is experienced in the mucous membrane of the mouth and even of the ears. That these symptoms are due to pollen was conclusively demonstrated by Blackley's¹ experiments, who injected a drop of the infusion of the pollen of gladiolus into the eye, producing almost instantly intense congestion of the membrane, which was soon followed by œdema, with pain and photophobia. In the same way Blackley found the mucous membrane of the mouth susceptible to the same influence.

The mucous membrane of the upper air-tract very soon shows evidence of mild inflammatory trouble, in many instances, which is to be attributed rather to the interference with the function of the nasal chambers than to the impact of the pollen. Thus, hoarseness, loss of voice, and cough may develop. This is especially liable to occur after the patient has suffered his annual attacks for a number of years. The distressing symptoms of the attack persist during the waking hours with little abatement, but at night there is a notable amelioration of the condition. This is probably due to the fact that the atmosphere of the sleeping-apartments is not so fully charged with pollen as that which is inhaled during the day.

The onset of the attack is not infrequently marked by a feeling of general malaise, loss of appetite, and depression of spirits. These symptoms, moreover, characterize the whole course of the attack to a more or less well-marked extent. Aside from this we do not ordinarily meet with any evidences of general systemic disturbance. Thus, Blackley,² in a series of observations with reference to the pulse and temperature, found no deviations from the normal.

After the affection has persisted for a period varying from one to two weeks, in a certain proportion of cases, an attack of asthma sets in, marked by the symptoms which ordinarily characterize a paroxysm of spasmodic asthma. The asthmatic symptoms are confined to the night-time, as a rule, although the waking hours are characterized by a certain amount of shortness of breath, with what patients describe as "wheezy" sensations. Asthma is not often observed with the first attack of hay-fever, but is liable to develop after the disease has persisted for a number of years. A certain clinical connection is thus clearly established between hay-fever and asthma. The question arises as to what the direct connection may be, and whether

¹ Op. cit., p. 103.

² Op. cit., p. 205.

the asthmatic symptoms result from the impact of the pollen upon the bronchial mucous membrane in the same way that the hay-fever symptoms arise in the nasal mucous membrane. If this were true, I think that we should naturally expect the asthmatic symptoms to develop coincidentally with the nasal symptoms. This very rarely occurs, and moreover, as we have seen, the asthma does not set in until the patient has suffered from a number of annual recurrences of the hay-fever.

In writing on this subject some years since,¹ I first advanced the theory that hay-fever and asthma were practically one and the same disease, the former consisting of a vaso-motor paresis of the blood-vessels coursing in the nasal mucous membrane, while the latter is a vaso-motor paresis of the vessels coursing in the bronchial mucous membrane. Furthermore, I argued that underlying an attack of asthma was the neurotic habit, in which there exists a special susceptibility to vaso-motor paresis in certain areas. Anything which tends to weaken vaso-motor control in any region of the body, in a patient with a neurotic habit, is to be regarded as an active predisposing cause of the development of the disease. There is an intimate and quick sympathy between the nasal mucous membrane and that of the bronchial tubes, established by the existence of the important respiratory apparatus which is constituted by the turbinated bodies. Anything which causes dilatation of the blood-vessels of the nose tends to be followed by a similar condition in the bronchial mucous membrane. This latter is to an extent weakened, in that the impeded respiration which characterizes hypertrophic rhinitis tends to develop rarefaction of air in the passages below, and thereby vascular dilatation. We have then, in an attack of hay-fever, all the conditions present which should render a paroxysm of vaso-motor bronchitis or asthma especially liable to occur. There are nasal stenosis, vascular dilatation, the intimate sympathy existing between the two regions, together with the neurotic habit. An attack of hay-fever, therefore, is especially liable to develop an attack of bronchial asthma, not from the impact of pollen on the bronchial mucous membrane, but purely as one of the conditions which may arise as a natural sequela of the disturbance in the nasal chambers. I do not say that the pollen exerts no influence upon the bronchial mucous membrane; it is probable that the atmosphere which reaches the bronchial passages is moderately surcharged. Most of the pollen-grains, however, are arrested in the passages above. The reason that the asthma does not set in immediately upon the onset of the hay-fever is found in the fact that the vaso-motor paresis in the parts below only occurs after the blood-vessels have been subjected to the weakening influence of the intra-nasal disease for a certain period of time.

It is a somewhat notable fact that after a patient has suffered for a number of years with hay-fever in connection with asthma, the asthmatic attack comes on somewhat earlier each year, until finally its ad-

¹ New York Medical Journal, April 24 and May 1, 1886.

vent is coincident with the hay-fever symptoms. I have observed in a number of cases who were subjected annually to attacks of hay-fever with asthma, that the hay-fever symptoms gradually abated while the asthma became the prominent factor, and that finally, in certain instances, with each annual recurrence of the season the patients were seized with attacks of asthma in which the nasal symptoms were exceedingly mild in character. In still rarer instances I have observed cases in which patients who had suffered for a number of years from simple hay-asthma finally became victims of the perennial form of disease, the attacks occurring at all seasons and without reference to the presence of pollen in the atmosphere.

Course and Duration.—By far the most prevalent form of hay-fever which is met with in this country is that in which the annual attack commences in the latter part of August and lasts until cold weather. All forms of hay-fever terminate with the first frost, as we know, because the activity of all pollen is completely destroyed when the thermometer reaches the freezing-point. That form of the disease which commences in the latter part of August is usually designated as autumnal catarrh. The usual date assigned for its commencement is the 29th of August. Many patients assert that their annual attacks recur on exactly the same date and even at the same time of day. This, of course, as before stated, is only the result of mental anticipation. In patients in whom this mental condition does not exist, the recurrence of the exacerbation varies greatly in different years.

I know of no reason why so large a number of cases should assume the autumnal form of the disease, other than the fact that at this period the pollen of ragweed is the cause of the attack. This weed, as we know, is widely disseminated, and grows with a luxuriance that is equalled by few other of the anemophilous plants. Its specific action in individual cases has been so clearly demonstrated by Wyman, Marsh, and others, that we must accept it as probably the most active of the causes of autumnal catarrh.

Another variety of hay-fever is that which sets in about the 10th of June, and which is commonly designated as a rose-cold, from the fact that it seems to be excited by the action of the pollen of the different varieties of roses which flower at this season of the year. Beard¹ seems to attach especial importance to the fact that he had demonstrated the existence of a third variety of the disease in which the attacks came on in September. I do not think any classification of these cases feasible, since the idiosyncrasy which renders patients liable to the action of the pollen of the various flowering plants is peculiar in each case to the individual himself, and hence while one patient is susceptible to the action of one pollen, another patient may be affected by a totally different pollen, and their annual attacks only come on when the atmosphere is permeated by the special

¹ Op. cit., p. 49.

pollen to which they are individually susceptible. I do not mean by this that every individual is susceptible to only a single pollen, for many are susceptible to a number. Thus, we not infrequently meet with patients who not only suffer from rose-colds in the early summer but also from the autumnal form of the disease in August. The following analysis by Beard¹ shows the great variation which is observed in the time of the annual recurrence. Thus, of the one hundred and ninety-eight cases which he collated, the onset of the disease occurred—

From May 1 to May 10	in 2 cases.
" May 10 to May 31	" 6 "
" June 1 to June 10	" 11 "
" June 10 to June 30	" 8 "
" July 1 to July 10	" 6 "
" July 10 to July 20	" 6 "
" July 20 to July 31	" 7 "
" August 1 to August 10	" 7 "
" August 10 to August 20	" 81 "
" August 20 to August 31	" 54 "
" September 1 to September 10	" 7 "
" September 10 to September 20	" 1 case.
" September 20 to September 30	" 2 cases.

The following analysis of my own cases² is more interesting, as showing the duration of the annual attacks. Thus,—

From May 1 to frost	1 case.
" May 15-May 25 to July 1	3 cases.
" May 10 to August 1	1 case.
" June 1 to July 1	2 cases.
" June 1 to July 14	1 case.
" June 1 to frost	5 cases.
" June 10 to July 4	4 "
" June 10 to July 26	5 "
" July 1 to September 1	1 case.
" July 10 to August 1	1 "
" July 10 to September 1	1 "
" July 25 to frost	4 cases.
" August 10 to August 27 to frost	51 "

A mere glance at these statistics demonstrates conclusively the futility of any attempt at a close classification of the various forms of hay-fever. Of course it is possible that by careful study and experimentation in each case it might be feasible to determine the definite source of the flowering pollen which was active in each individual case. It is probable, however, that by this means we might show that in certain cases but a single pollen was the active cause of the disease, while in others we would find patients susceptible to a very large number or group of pollens. Thus, in my own records

¹ Op. cit., p. 50.

² Diseases of the Nose and Throat, vol. i. p. 216, New York, 1889.

I find a case who suffered from the attacks from the 1st of May until cold weather. The neurotic habit was very pronounced in this instance, and the patient was undoubtedly susceptible to a very large number of the various kinds of pollen.

The statistics given above refer to the disease as we observe it in America, wherein the very large proportion of cases suffer from the autumnal form of the affection. In England the attacks usually set in during the months of May and June and rarely last longer than until September. The same is true of France and Germany and others of the Continental countries.

Geographical Distribution of the Disease.—Wyman¹ devotes a large proportion of his excellent treatise on the subject of autumnal catarrh to a consideration of the regions of country where the disease is especially prevalent and those which are exempt. He seems to think that the affection confines itself mainly to the country east of the Mississippi River and between the thirty-fifth and forty-fifth parallels. In this region he found certain portions of the country which were exempt. These were Canada, the Adirondack Mountains, the Appalachian Range, and the elevated plateau throughout the centre of New York. He found that portion of the country which is west of the Mississippi River and south of the thirty-fifth parallel practically exempt from the disease, with the exception of certain limited districts in the neighborhood of Milledgeville, Georgia, Montgomery, Alabama, and Beaufort, North Carolina. Beard also, in his later investigations, seemed to think that the country west of the Mississippi River was exempt from the disease. These observations are entirely incorrect, for, with our increased knowledge of the affection, we learn that practically no portion of the United States is exempt, except certain elevated districts, such as the White Mountains, the Blue Ridge, the Adirondack region, and some high altitudes in the Western States.

It is a long-recognized fact that patients suffering from hay-fever in the valleys find relief by spending their summers in the White Mountains or the Adirondacks. I think the only explanation of this is that the flora of the elevated regions differs materially from the flora of the valleys, and that the flowering plants whose pollen is the source of the exacerbations are not found above a certain altitude. It was claimed by Beard that hay-fever did not prevail west of the Mississippi River. He explained this on the ground of the lack of vegetation and the sparseness of the population. I think a better explanation would have been found in the rugged character of the inhabitants and the vigorous health which resulted from their frontier life. With the extension of civilization to this region, we find hay-fever becoming quite as prevalent as other forms of nervous diseases. Southern climates are to an extent exempt from the disease. We explain this, I take it, by the fact that in the semi-tropical region of the South

¹ Op. cit.

catarrhal diseases do not prevail, and hence one of the active predisposing causes of the affection is absent.

For many years no region of the country has enjoyed a reputation so great as the White Mountains in affording relief to the disease. Curiously enough, with the increased facilities of communication and the establishing of a line of railroad through the mountains, this exemption has to an extent disappeared. It would be an interesting question to observe whether this might not be the result of the extension of the flora of the valleys into these elevated regions.

Diagnosis.—The pronounced character of the symptoms, together with the periodicity of the attack, and especially its prompt termination on the occurrence of the first frost, in the autumnal form of the disease, would seem to afford us clinical symptoms which would render a diagnosis comparatively easy. Curiously enough, we not infrequently meet with cases in which the annual attack has recurred even for several years without the patient discovering the character of the disease from which he suffered. When once seen, however, such a failure of recognition need scarcely be made on the part of a physician. The only disease with which it need be mistaken, of course, is an ordinary acute rhinitis, but, as we have seen, hay-fever differs essentially from the ordinary cold in the head, in the fact that the latter is marked by several stages,—namely, first, a dry stage, lasting about twelve hours; second, a stage of serous discharge, lasting from two to three days; and third, a stage characterized by a profuse muco-purulent discharge which lasts from three to five days; the whole affection running its course in from five to ten days. In hay-fever, on the other hand, the discharge is a serous discharge from the onset, and is practically so during its whole course. There is never a muco-purulent discharge, although the serum may contain viscid mucus and a few epithelial cells, sufficient to render it very slightly opaque. Moreover, an acute rhinitis is not usually characterized by the violent and persistent attacks of sneezing which occur in hay-fever.

An examination of the mucous membrane should always serve to establish the existence of a morbid condition which is due purely to a vaso-motor paresis. The appearance of the membrane is characteristic, and resembles in no respect an inflammatory process. It is markedly swollen, giving rise to more or less complete occlusion of the nares, but is of a bluish-gray color, which in every respect differs from the appearance of the membrane in a state of acute inflammation, which, as we know, is of a bright red color. This is due to the fact, already noticed, that the vaso-motor paresis confines itself entirely to the venous sinuses which compose the turbinated bodies, the capillaries which course in the mucosa proper not being involved, and therefore the surface of the membrane shows no evidences of congestion. Moreover, the mucous membrane in hay-fever is covered with a thin, slightly viscid, watery serum, which gives it a glassy and semi-translucent aspect.

The suffusion of the eyes, with photophobia, should also afford a certain amount of information, although this may occur in connection with an acute rhinitis.

Prognosis.—Although the disease is one which entails no little discomfort and even suffering to the patient during the exacerbations, it does not seem to involve any special menace to the general health. The prognosis, therefore, is not a grave one. The tendency to the development of a periodical asthma and eventually of a perennial asthma is one that should always be borne in mind.

Of course the interesting question in this connection is as regards our ability to cure the disease. This, in late years, has been the subject of no little discussion. Occasionally the disease disappears spontaneously. This is especially noticeable, I think, in young children and in cases of rose-cold. This tendency, however, is not one, of course, that can be depended upon, and is manifested in but a small proportion of cases. That the disease can be cured cannot be questioned in view of the large number of cases reported by various observers. That all cases can be cured, as some claim, is very questionable. I doubt if any physician is warranted in holding out an absolute promise of a cure in any given case. We can only assure our patients that probably a majority of cases are curable, and that much relief certainly can be afforded in the larger proportion of cases.

I have had under my own personal care and treatment one hundred and twenty-one cases, in which the records are complete. In addition to these cases it is interesting to note that four patients came under treatment for some diseased condition of the upper air-passages, who reported that in previous years they had suffered from annual attacks of hay-fever which seemed to have disappeared spontaneously. This will, perhaps, represent a fair proportion of instances in which a spontaneous cure may be looked for. Of the above cases the results of treatment were as follows: cured, fifty-one; relieved, forty-three; unrelieved, thirteen; results unknown, fourteen. The above cases include not only cases of periodical vaso-motor rhinitis or hay-fever, but also several instances in which the symptoms were perennial, such as I have elsewhere described under the term "nasal hydrorrhœa."¹

Roe² has found even better results than these, since of forty-four cases under treatment thirty-six were cured, although he states that in sixteen of these thirty-six there was some return of the symptoms.

The development of hay-asthma in connection with the attacks does not seem to influence unfavorably the prognosis. As before stated, this is not to be regarded as an evidence that the neurotic habit has more fully developed in the individual, but is to be regarded merely as a sequela of the disease. That this does not seriously complicate the affection is well illustrated in an analysis made by the writer³ of eighty cases of asthma. Thirty-

¹ Diseases of the Nose and Throat, vol. i. p. 258.

² American Journal of the Medical Sciences, September, 1888.

³ Ibid.

four of these were cases of hay-asthma, and of these eighteen were cured, fourteen relieved, one unrelieved, and one lost sight of,—a better result even than that given above in the one hundred and twenty-one cases of hay-fever.

Age has an undoubted influence upon the prognosis, since the younger the patient the better is the promise of relief. Rose-cold would seem to belong more especially to the earlier period of life, and hence the prognosis, I think, should be regarded as somewhat more favorable than that of the autumnal form of the disease. At best, hay-fever is essentially a treacherous and somewhat fickle disease, and even in those cases which seem to offer a promise of the best results, as in patients in vigorous health, and in whom the local morbid lesion in the upper air-tract is pronounced, we are not infrequently disappointed in our anticipations of good results from treatment.

While, therefore, we are warranted in the expectation of affording complete relief in a fairly large proportion of cases, it is unsafe in any individual instance to give an absolutely favorable prognosis.

TREATMENT.

As already noted, we have found three factors which we regard as essential in the production of an attack of hay-fever. The treatment of the disease, therefore, will consist in, *first*, measures for the correction of the neurotic habit; *second*, local treatment for the relief of such morbid conditions as may be found in the upper air-tract; and *third*, the treatment of the exacerbation.

Constitutional Treatment.—Various internal remedies have been recommended for the relief of the disease, dating back to the time of its first recognition, which practically recognized the neurotic habit, although not avowedly. Among these are belladonna, zinc, arsenic, phosphorus, strychnia, hydrocyanic acid, valerian, asafoetida, musk, lobelia, amber, bromides and iodides, chloral, opium, hyoseyamus, quinine, and the various preparations of iron. The usual manner in which these were given was to commence their administration from ten days to two weeks before the annual attack was expected, and thus to bring the system thoroughly under their influence, in order that the local symptoms might be thus ameliorated. Blackley was a homœopathic physician, and his experiments in the therapeutics of the disease seem to have been quite as thorough as those which were used in the study of its causation. He found the administration of the arsenite of potash and the arsenite of quinine attended with excellent results, but the greatest relief was afforded, in his experience, by the exhibition of the iodide of zinc in doses of one-two-hundredth of a grain. Beard¹ and McCullough² both advocated the use of quinine, the latter stating that it has “helped more cases than any other single remedy.” The use of the bromides does not seem to have been attended with any good results, although

¹ Op. cit., p. 158.

² Remittent and Intermittent Diseases, London, 1828.

in combination with chloral they are often rendered necessary to quiet nervous irritability and to produce sleep during the exacerbation. La Forge¹ claims to have got excellent results from the administration of belladonna in connection with opium, while Dechambre² found it equally efficient administered in connection with quinine. He advised that it be given in gradually-increasing doses until its physiological effect is obtained, when the amount is decreased. These results are to be attributed to the specific action of belladonna on the vaso-motor system of nerves, although the observations were made before this feature of the disease was recognized. A better method, I think, than Dechambre's, is to commence the administration of the drug about two weeks before the attack is expected and to continue it until the end of the period. Mackenzie³ believes that "valerianate of zinc in combination with asafœtida is more valuable than any other drug." He administers one grain of the zinc with two grains of compound asafœtida pill, commencing before the attack sets in, and at the end of two weeks doubles the dose. I regard belladonna as exercising a more specific and thorough control of the disease than any other drug, and next to this I am disposed to place reliance in the therapeutic value of some preparation of zinc. The following combination in my own experience has been attended with most excellent results :

R Zinci phosphidi, gr. viij;
 Extract. belladonnæ, gr. x.—M.
 Fiat mass. in pil. no. xl. div.
 Sig.—One pill three times a day after eating.

Impairment of general nutrition is not ordinarily observed in these cases. When this is noted, however, the administration of arsenic in combination with the above will be found efficacious, adding a single grain of the arsenious acid to the above prescription, thus administering it in doses of one-fortieth of a grain.

The administration of these drugs should be commenced at least two weeks before the onset of the attack. Unfortunately, these patients do not often present themselves at that time. We are more liable to meet them during the exacerbation or immediately after it. If they are seen during the exacerbation, the above remedies should be administered in the same manner. If seen immediately after an attack, I see no reason why the beneficial action of these drugs on the nervous system should not be secured by a course of internal medication extending over from six weeks to two months.

There are certain general remedies which I regard as of special value in the correction of the neurotic habit; these consist in the regulation of

¹ Union Médicale, December 7, 1859.

² Gazette Hebdom., p. 67, 1860.

³ Hay-Fever and Paroxysmal Sneezing, 4th ed., p. 66, London, 1877.

the clothing and the habits of life. These have already been sufficiently discussed in the chapter on acute rhinitis, and need not be entered upon here. There is one measure, however, which I regard as of the greatest importance: this consists in the judicious use of cold water, especially as applied to the spine. A cold sponge-bath is not sufficient; what is especially desired is the tonic effect produced on the spinal nerves by the sudden and decided shock of cold water on the back. This is excellently accomplished by the use of the cold shower-bath. This, however, is not always well tolerated, while patients do tolerate the cold sponge to the spine. The plan is not a new one, for we find it recommended by Gordon¹ as early as 1829, who especially emphasizes the value of cold water in the treatment of these cases. Kinnear² also reports six cases of hay-fever in which excellent results were obtained by the daily application of ice-bags to the spine, the application being continued for from an hour to an hour and a half.

In addition to the above measures, the sleeplessness and nervous irritability which the attack entails will not infrequently necessitate the administration of anodynes to secure sleep. For this purpose opium is undoubtedly the most efficacious. Mackenzie³ finds the best effects from the use of the tincture, giving from five to seven drops twice daily. Morehead⁴ recommends the hypodermic administration of morphine, one-twentieth of a grain, in combination with one-two-hundredth of a grain of atropine, given twice daily; or, better still, one-twentieth of a grain of the tartrate of morphia gradually increased, as the attacks develop, to one-tenth of a grain. It is probably not safe to give as large a dose as this through any long period of time, and hence it will be wiser, perhaps, to resort to less dangerous anodynes, such as hyoseyamus, the bromides, or sulfonal.

The Treatment of the Diseased Condition of the Upper Air-Passages.—The active discussion of the subject of hay-fever and its curability has been largely carried on by those who have made a special study of diseases of the throat and upper air-passages, and I think it is fair to claim that the most successful results in affording relief from the disease have been attained by methods of treatment directed towards the removal of such morbid conditions as may be found in the nasal passages. If the results obtained by these observers can be relied on, it seems to me that a causative relation to catarrhal affections in the upper air-tract is clearly established, and in this point of view, therefore, becomes of special importance, in that we have here definite conditions which can be recognized on ocular inspection, and definite indications for treatment. Moreover, we are enabled by ocular inspection to fully estimate the success which has attended our

¹ London Medical Gazette, vol. iv. p. 266, 1829.

² New York Medical Record, July 14, 1888, p. 82.

³ Op. cit., p. 66.

⁴ British Medical Journal, vol. ii. p. 18, 1886.

measures. The treatment is not new, for as early as 1837, Cazenave¹ recommended that the mucous membrane of the nose should be cauterized with nitrate of silver. This plan seems to have been attended with a certain amount of success until the galvano-cautery was introduced by Middel-dorpf,² when the use of this device became a favorite procedure. These measures were used without any definite recognition of indications. Of course we do not treat hay-fever with caustics in this manner, but we occasionally find it necessary to resort to this measure for the removal of those morbid lesions in the nasal passages which predispose to the disease. These are hypertrophic rhinitis, deflections of the septum, nasal polypi, nasopharyngeal catarrh, and indeed any obstructive lesion in the upper air-tract which tends to induce a turgescence of the blood-vessels in the nasal mucous membrane.

The indications for treatment, therefore, are only made clear by a careful inspection of the parts and a recognition of such lesion as may exist. If nasal polypi or other tumors are discovered, they should be removed; if a deflection of the septum exists, the normal patency of the passage should be restored by its ablation; if hypertrophic rhinitis or chronic hyperæmia of the nasal mucous membrane is found, this should be reduced by the judicious use of caustic applications. Briefly, the indications for local treatment are fully carried out in restoring the normal patency to the whole of the upper air-tract, thus enabling the process of respiration to go on in a perfectly normal manner and without entailing any diminution of air-pressure in any portion of the breathing passages. Sajous³ lays special stress on the superficial cauterization of the nasal mucous membrane, by which nutrition is altered. This seems rather obscure and fails to give us any definite clinical indication. In a later contribution⁴ the same writer emphasizes the necessity of confining the caustic applications to the sensitive areas in the nose, as previously described by John Mackenzie.⁵ The importance of these sensitive areas of John Mackenzie I have always regarded as being greatly overestimated. They are simply found in that portion of the nasal mucous membrane where the turbinated bodies are most highly developed. This unusually high development necessarily entails an unusually rich nervous distribution for the regulation of functional activity. Those portions of the nasal mucous membrane, therefore, where the venous sinuses which form the turbinated bodies are more largely developed, are unusually sensitive. This sensitiveness is merely an adventitious feature, and does not carry with it any indications for treatment; they belong to health as well as to disease. The indications for treatment in hay-fever

¹ Gazette Médicale, p. 31, 1837.

² Die Galvano-Kaustik, Breslau, 1854.

³ Medical and Surgical Reporter, Philadelphia, December 22, 1883.

⁴ Diseases of the Nose and Throat, Philadelphia, 1886.

⁵ New York Medical Record, July 19, 1884; and American Journal of the Medical Sciences, July, 1883.

are the control of turgescence, and not the destruction of tissue or the abolition of hyperæsthetic conditions. I am disposed to think that such success as has been obtained by cauterizing these sensitive areas has been simply from the reduction of turgescence accomplished in this way.

Treatment of the Exacerbation.—In the earlier literature of hay-fever we find many observers recording with a certain degree of enthusiasm their success in controlling the local symptoms of the disease by means of certain topical applications. Thus, Elliotson¹ claimed excellent results from the use of the chlorides in solution in connection with vaporous inhalations. Cazenave² warmly advocated the irrigation of the parts with weak solutions of bichloride of mercury. Helmholtz's original observation of the efficacy of quinine was followed by a somewhat extended and successful use of this remedy, until De Budberg³ showed conclusively that a solution of chlorate of potash was quite as efficacious, and Sir Andrew Clark⁴ even quite recently has claimed excellent results from the local application of a solution of quinine, carbolic acid, and bichloride of mercury in combination. Binz⁵ found salicylic acid efficient in controlling local symptoms. I question if any of these remedies exercises any notable controlling influence on the local process. When the pollen theory was first demonstrated, the attempt was made to control the local manifestations in the air-tract by protecting the mucous membrane from the impact of the pollen. Thus, Blackley⁶ found notable relief from wearing a wire gauze respirator. Mackenzie⁷ advises that the nostrils be plugged with cotton wool. The discomfort attending these methods, with the failure to afford notable relief in most instances, scarcely warrants us in recommending patients to resort to them.

No local remedy which has yet been introduced more clearly and directly carries out the indications in relieving the local manifestations of hay-fever than cocaine, since this drug not only produces insensibility in the membrane but reduces plethora, thus controlling the two essential conditions which characterize an exacerbation. The value of its action I regard as practically in contracting blood-vessels, rather than in its anæsthetic properties. This remedy, I think, may be safely placed in the hands of patients for use by means of a spray, using a two-per-cent. solution, which is thoroughly efficacious in most of these cases. It is always to be borne in mind, however, that cocaine is liable to produce a constitutional effect, resulting in disturbance of the heart's action, nervousness, and sleeplessness. Watching somewhat carefully its action in this respect, and restricting its use as far as

¹ London Medical Gazette, vol. viii. p. 411, 1831.

² Loc. cit.

³ British Medical Journal, vol. ii. p. 18, 1881.

⁴ Ibid., June 11, 1887.

⁵ Deutsche Medicinische Wochenschrift, September 27, 1877.

⁶ Op. cit., p. 260.

⁷ Diseases of the Throat and Nose, Am. ed., vol. ii. p. 310, Philadelphia, 1880.

possible, I see no reason why patients should not be afforded the very marked relief to local symptoms which it is able to give. Beverley Robinson¹ asserts that after the turgescence has been subdued by the local application of cocaine the relief is but temporary, and there follows a reaction in which the vascular dilatation is even greater than before. This certainly has not been my own experience. As before stated, relief follows very promptly upon the first application, but is not permanent and rarely lasts more than from half an hour to two hours, varying notably in different cases. In this manner the repetition of the application will be demanded at varying intervals, according to the relief afforded. The formula which I prefer is as follows :

R Cocainæ hydrochlorat., gr. xx ;
Sodii bicarb.,
Acidi borici, ãã gr. x ;
Aquæ, f ʒ i.—M.

We thus commence with a four-per-cent. solution, which is to be used by means of a small atomizer and applied as frequently as may be needed. The patient should be directed to gradually weaken this solution, carefully noting the amount of dilution, until the weakest solution is arrived at which will afford relief. In many cases I have found that a one-per-cent. or even a half-per-cent. solution acts quite as favorably as the stronger preparation. In many cases a still better method of using this drug consists in making a suspension of the cocaine solution in one of the petroleum oils, as follows :

R Cocainæ hydrochlorat., gr. x ;
Aquæ, q. s.
M., fiat solutio.
Adde albolene, f ʒ i.

This is to be used in one of the large atomizers adapted for the petroleum oils. This not only affords the controlling action of cocaine in reducing turgescence, but also coats the membrane with the albolene in such a way as notably to protect it from the impact of pollen. It has been asserted that the use of cocaine is dangerous in producing an enslaving habit. I have been a somewhat interested and careful observer of this subject, and while I am not ready to state that there is no cocaine habit, I unhesitatingly make the assertion that no case of so-called cocaine habit has come under my own observation in which I was not convinced that the drug was used in connection with either alcohol or opium ; in other words, I have seen no case of pure cocaine habit. While I recognize a certain danger in the careless use of this drug, and would hesitate to prescribe it in any case without a careful watchfulness, I am disposed to think that its dangers are somewhat overestimated. Mackenzie² recommends the use of gelatin bougies containing a tenth of a grain of cocaine combined with

¹ New York Medical Record, October 17, 1885, p. 425.

² Hay-Fever and Paroxysmal Sneezing, 4th ed., p. 62, London, 1877.

the one-hundred-and-twentieth of a grain of atropine. These are to be inserted into the nasal passages and allowed to melt. I am disposed to think that most of the more distressing symptoms of the disease are the result of a turgescence of the middle turbinated bodies rather than of the lower. Such an application as this, of course, would not thoroughly reach the parts. Robinson¹ reports a number of cases in which cocaine failed entirely to give relief to hay-fever, and in which he obtained notable success from pencilling the mucous membrane with one part of carbolic acid in three parts of glycerin. One of his cases was completely cured, and two were notably relieved.

Occasionally I have found excellent results from directing the patients to make use of a snuff composed of the following :

R Cocainæ hydrochlorat., gr. x ;
Bismuthi subcarb., ℥i ;
Magnesii calc., ℥ij ;

or :

R Hydrarg. chloridi mitis, gr. v ;
Cocainæ hydrochlorat., gr. x ;
Sacch. lactis, ℥ij ;

If there is much nervous irritability, a small amount of morphine may be administered in a snuff, as follows :

R Morphinæ tartratis, gr. i ;
Cocainæ hydrochlorat., gr. x ;
Sulphuris flor., ℥ss ;
Sacch. lactis, ℥ij.

Hinkle² has obtained favorable results from the local application of antipyrin alone or in combination with cocaine ; while Cheatham³ and Brooks⁴ have obtained equally good results from the internal administration of antipyrin, which would suggest that possibly Hinkle's results may have depended upon the constitutional action of the drug.

The eye-symptoms are occasionally so distressing in character as to require attention. Temporary relief, of course, will be afforded by the application of cocaine. Here, however, a no stronger solution than one per cent. should be used. Cheatham⁵ makes the suggestion that eserine in the strength of one twelfth of a grain to the ounce should be added to the cocaine solution in order to prevent dilatation of the pupil. As a rule, however, the use of colored glasses, as first suggested by Cazenave,⁶ will be found to afford sufficient relief to this condition.

¹ Loc. cit.

² New York Medical Journal, October 20, 1888, p. 429.

³ Annual of the Universal Medical Sciences, vol. iii. p. 267, 1888.

⁴ British Medical Journal, May 19, 1888.

⁵ New York Medical Record, November 21, 1885, p. 567.

⁶ Loc. cit.

NEUROSES OF THE NOSE AND NASOPHARYNX.

BY JOSEPH A. WHITE, A.M., M.D.,

Senior Surgeon to the Richmond Eye, Ear, Throat, and Nose Infirmary,
Richmond, Virginia.

NEUROSES of the nose and naso-pharynx may be divided into *neuroses of olfaction*, or alterations of the sense of smell, and *reflex nasal neuroses*, which comprise a host of morbid phenomena, sensori-motor, vaso-motor, and trophic, which at times emanate from impressions made on the olfactory or the trigeminus and its sympathetic connections.

PART I.

NEUROSES OF OLFACTION.

Neuroses of olfaction, or alterations of the sense of smell, may be divided into parosmia, or parosphresia, hyperosmia, or hyperosphresia, and anosmia, or anosphresia.

PAROSMIA, OR PAROSPHERESIA.

Parosmia, or parosphresia, is a perversion of the sense of smell, so that, whilst the special sense remains perfect for all odors, the individual is afflicted by imaginary odors.

For its perfect action the sense of smell must have normal olfactory bulbs, healthy mucous membrane,—covering the superior turbinated, the upper half of the middle turbinated, and the upper three-fourths of the posterior part of the septum,—and free access of air with the odorous particles to excite the nerve-filaments.

Perversion of the sense of smell may result from any change in these necessary conditions for normal olfaction. Whilst it may be apparently normal to all intents and purposes, one may be annoyed by imaginary odors, such as gas, petroleum, urine, etc., due probably to some pathological condition of the olfactory nerve or bulb or to some brain-lesion.

That imaginary odors can be purely subjective is evidenced by such cases as Bernard's,¹ in which the autopsy revealed an absolute destruction of the olfactory nerves, although the patient had complained of unpleasant

¹ Froriep's Notizen, vol. xi.

smells whilst living. Such subjective hallucinations are common among the insane. They are also met with in epilepsy, hysteria, syphilis, etc. I have once observed this symptom in a case of atrophic rhinitis, where objective odors could not be perceived.

That it can result from simple catarrhal rhinitis, causing peripheral excitation, would appear from the fact that during the recent epidemic of "la grippe" I saw cases of perverted olfaction where the patients were annoyed by unpleasant tastes and smells for days, such as the odor of carrion, stable manure, etc. Onodi¹ records similar cases.

This may be the result of altered nasal secretions from the catarrhal conditions which accompany "la grippe," but it can also be of central origin from the cerebral irritation so frequently observed during influenza. Over-stimulation of the nerve-endings by a powerful odor can also cause perverted olfaction (Warden).²

HYPEROSMIA.

Hyperosmia, or hyperosphresia, is a hyperæsthesia of olfaction, and sometimes follows exhausting diseases which impair the nerve-force and exaggerate all nervous impressions; or it may be due to local irritation of the olfactory bulbs, causing a hypersensitive condition; or it may be associated with hysteria, hypochondria, or neurasthenia (Baumgarten).³ In hyperosmia odors that ordinarily are not noticeable will produce a most profound impression, and smells not perceptible to a healthy nasal organ will give great annoyance. Unpleasant odors are often retained for hours after the offending substance is removed.

Abnormal function of the olfactory nerve is sometimes of reflex causation, from troubles of the sexual organs, especially in women (Peyer).⁴

I have met with a case where exaggerated sense of smell invariably developed at each menstrual period, but was accompanied by hyperæmia and slight turgescence of the mucous lining of the nose. Such cases show the intimate relations between the nasal mucosa and the sexual organs by way of the sympathetic, a connection demonstrated by John N. Mackenzie⁵ in his remarkable essay on this subject. In the same connection Gottschalk⁶ reports a case of a lady thirty-six years of age who had both ovaries extirpated on account of uterine myoma: one year later the patient had entirely lost the sense of smell. There was no spinal irritation, and no assignable cause for the anosmia. Gottschalk believed there was a relation between the artificial climacterium and the anosmia.

¹ Monatschrift für Ohrenheilkunde, March, 1891.

² Parosphresia and Parageusia, Journal of Laryngology and Rhinology, May, 1889.

³ Pester Med.-Chirurgische Presse, No. 9, 1889.

⁴ Münchener Medicinische Wochenschrift, Nos. 3 and 4, 1889.

⁵ Irritation of the Sexual Apparatus as an Etiological Factor in the Production of Nasal Disease, American Journal of the Medical Sciences, April, 1884.

⁶ Deutsche Medicinische Wochenschrift, No. 26, 1891.

ANOSMIA.

Anosmia, or anosphresia, loss of smell partial or complete, is the more common and most important clinically of the alterations of this special sense. It can be congenital or acquired, but congenital anosmia is very rare.

It is very frequently developed temporarily by acute catarrhal inflammation of the nasal passages, or a so-called cold in the head, and by any other change in the nasal passages that prevents free access of air to the upper nasal chambers.

H. Zwaardemaker¹ suggests a division into anosmia respiratoria and anosmia expiratoria, according as the smell-act is inspiratory or expiratory, —i.e., whether interference with reaching the olfactory fissure is in the anterior nasal passages, as for external odors, or in the choanæ or post-nasal region, as for odors accompanying the acts of eating and drinking; for perception of odors during expiration is not so limited as was supposed (Aronsohn).²

He also divides anosmia into anosmia essentialis and anosmia intracranialis, according as the nerve-endings of the olfactory cells or nerves themselves are pathologically altered, or the central olfactory apparatus in the brain is affected.

Anosmia respiratoria is brought about by asymmetry of the nasal chambers, or by any obstruction to nasal ventilation. In deflections of the septum, exostosis, enchondroma, etc., it is often unilateral, and usually on the side of the convexity of the septum. In hypertrophy of the mucosa when present it is usually bilateral. In acute rhinitis, temporary and bilateral anosmia is frequent, as above mentioned.

Polyps—which can also produce essential anosmia by pressure in the pars olfactoria—are among the common causes. Tumors of the pharynx and naso-pharynx also produce it. Paralysis of the alæ nasi and absence of the external parts of the nose both impair or abolish the sense of smell, but in the latter instance it has been restored by the formation of an artificial nose (Béclard, quoted by Zuckerkandl).³

Essential anosmia can be unilateral or bilateral, temporary or constant. It can be primary from the effects of irritating gases, as in the case of Althaus,⁴ of a physician who lost the sense of smell after the dissection of a gastric carcinoma, in which he suggests a capillary hemorrhage as the probable pathological alteration; or of strong and disagreeable odors (R. J. Graves).⁵

Excessive and repeated irritation, as in constant inhalation of tobacco-

¹ Weekbl. van het Nederl. Tijdschr. voor Geneesk., No. 9, 1889.

² Archiv für Anatomie und Physiologie, 1880.

³ Normale und Pathologische Anatomie der Nasenhöhle, Wien, 1882.

⁴ Lecture on the Physiology and Pathology of the Olfactory Nerve, Lancet, May, 1881.

⁵ Dublin Journal of Medical and Chemical Science, 1834.

smoke (more common in cigarette-smokers), has been known to impair the sense of smell (Edward F. Parker).¹ Congenital anomalies of the olfactory epithelium and nerve-filaments, such as absence of the pigment, are sometimes the cause (Dundas Grant).² Injury by a blow (Legg),³ or traumatism of the nerve, by tearing at the ethmoid foramen from fracture of the base of the skull (Notta)⁴ or of the ethmoid plate (Ogle),⁵ causes anosmia. It has been produced temporarily by cocaine applications (Zwaardemaker).⁶

Usually it is secondary to chronic rhinitis, extending from the pars respiratoria to the pars olfactoria, and ending in atrophy; to a chronic pharyngitis, as in Lennox Browne's⁷ case of anosmia, where no reason could be found beyond a chronic pharyngitis and relaxed uvula, and where abscission of the uvula resulted in a cure; to adenoids or polyps; to syphilitic alteration of the nasal mucous membrane; and to excessive or diminished secretion. Persons, *e.g.*, with dry mucous membrane can smell only in moist air.

The effect of section or paresis of the fifth nerve on olfaction is in all probability due to the alteration in the secretions of the nasal mucous membrane. It can also result from morphine, atropine, mercurial poisoning, etc.

The inflammation of the olfactory nerve commencing in the terminal filaments, or ascending neuritis, is a rare but possible cause.

Anosmia intracranialis can result primarily or secondarily. Primarily, from affections of the olfactory bulb and tract, as by wounds and tumors, when injury to sight may accompany the anosmia; by degeneration, as in locomotor ataxia (Althaus);⁸ by general paralysis; by senile decay; by syphilis, which can produce descending olfactory neuritis; by functional paralysis; by congenital absence of the olfactory nerves (cases reported by Haller, Valentine, Rosenmüller, Cerutti, Pressat, and others quoted by Sappey); and possibly by non-syphilitic olfactory neuritis. Secondarily, from injuries (Hamilton);⁹ hemorrhage (Hughlings Jackson,¹⁰ Ogle¹¹); meningitis; abscess (Oppert);¹² tumors (Loder);¹³ necrotic and atrophic processes (Prévost).¹⁴

¹ Anosmia from Tobacco-Poisoning, Philadelphia Medical News, September, 1890.

² On Anosmia, British Association of Laryngology and Rhinology, 1888.

³ A Case of Anosmia following a Blow, London Lancet, 1873.

⁴ Recherches sur la Perte de l'Odorat, Arch. Gén. de Méd., 1870.

⁵ Anosmia, or Cases illustrating the Physiology and Pathology of the Sense of Smell, Medico-Chirurgical Transactions, London, 1870.

⁶ Cocaine Anosmia, Fortschritte der Medicin, No. 13, 1889.

⁷ Diseases of the Throat, London, 1887.

⁸ Loc. cit.

⁹ Transactions of the College of Physicians, Philadelphia, 1870, vol. iv.

¹⁰ London Hospital Reports, vol. i. p. 410.

¹¹ Loc. cit.

¹² Dissertatio Inaug. de Vitiis Nervorum Organicis, Berolini, 1815.

¹³ Observatio Tumoris Schirrhosi in Basi Cranii reperti, Jen., 1790.

¹⁴ Gazette Médicale de Paris, 1866.

Unilateral anosmia has been met with in cases of aphasia, and Hughlings Jackson explains it by the passage of the external root of the olfactory past the island of Reil to the anterior part of the temporo-sphenoidal lobe. This cortical anosmia with aphasia, and sometimes with hemiplegia, is on the opposite side to the paralysis.

The usual location of the pathological process is at the base of the brain, and in the anterior fossæ, but the hippocampus, the thalamus, the posterior part of the internal capsule on the opposite side, and the pons are mentioned as having been the seat of disease that has affected the sense of smell, syphilis being the most frequent cause (C. L. Dana).¹ Hemianosmia from alterations in the internal capsule is one of the symptoms of Charcot's hysterical hemianæsthesia.

Symptomatology.—The evidence of this defect is an inability to perceive odors, which is often spoken of as a loss of taste, the absence of flavor in eating being more apparent than the loss of smell.

The relationship of the sense of smell and the sense of taste has been explained under the heading of anatomy and physiology, and there is no space to enter into its consideration here. But it is well known that the sensation of flavors is not gustatory, but olfactory, and that this deficiency is the means of recognizing anosmia in nearly all cases. Where there is an inability to perceive delicate odors and at the same time the perception of flavors is acute, there is only a partial loss of function of olfaction, usually due to nasal stenosis, or so-called anosmia respiratoria.

Where there is anosmia essentialis or intracranialis, unless in rare cases when it is unilateral, the sense of taste is correspondingly impaired.

Prognosis.—When anosmia is due to obstructive lesions in the nose, to malarial influences, to syphilitic changes, a favorable opinion may be given, provided that such loss of the olfactory function has not persisted so long that atrophy or degenerative alterations in the nerve-endings or in the nerve itself have taken place.

It is well known that any part of the economy which has been deprived of its functional activity for a long time will degenerate or atrophy, but it has never been and probably never will be definitely settled how long any function can be retained in a state of absolute inactivity. This uncertainty in some cases leaves the prognosis of many cases of anosmia doubtful.

According to Bosworth,² six or eight years of functional inactivity of the olfactory would result in the permanent loss of smell, from degeneration of the trunk or cerebral centres of the nerve. I have had two cases entirely cured by treatment of nasal disease, one in a lady who had lost the sense of smell for more than twenty years, and another where atrophic rhinitis had caused the same defect for more than ten years.

Notta³ reports a cure after loss of smell for fifteen years from polypi.

¹ New York Medical Journal, September, 1889.

² Diseases of the Nose and Throat, New York, 1889.

³ Loc. cit.

D'Agnano¹ records the case of a man who had anosmia forty years in consequence of a blow from a stone upon the naso-frontal region. The local treatment of the deviation of the septum and polypi was followed by complete recovery of smell when free respiration was restored.

These cases show the difference in functional activity in different individuals. Even in intracranial lesions recovery is sometimes met with, especially when the loss of smell is due to hemorrhage.

Diagnosis.—There is no difficulty about the diagnosis, but it is sometimes important in relation to prognosis and treatment that a differentiation be made between anosmia respiratoria (symptomatic) and anosmia essentialis and intracranialis.

A careful examination of the nose and naso-pharynx, and the presence or absence of any possible local causation for the loss of olfaction, will usually determine the question.

In testing for anosmia, substances should be used that affect only the olfactory nerve, and not acrid or pungent odors that stimulate the branches of the fifth pair.

Unilateral anosmia can be determined only by absolute occlusion of the other side, both back and front, when making the test. Zwaardemaker in an article in the London *Lancet*, January, 1887, has suggested a method of measuring the sense of smell clinically by an apparatus called the olfactometer, for a full explanation of which, from lack of space, I refer the reader to the article.

Treatment.—In parosmia and hyperosmia internal treatment directed to improvement of the general nervous system should be instituted. If there is any nasal disease, cocaine locally has been suggested as useful (Grazzi).²

In anosmia due to nasal stenosis, or to secretory changes in the nasal mucous membrane, the removal of all obstructive lesions and the restoration of the nasal mucosa to its normal condition is the only treatment.

In syphilitic changes, iodide of potassium internally, and galvanization of the olfactory nerve, will usually give good results. Strychnine and phosphoric acid in gradually increasing doses until physiological effects are produced is sometimes serviceable.

Althaus³ suggests the use of strychnine, not only internally, but also by local insufflation in powder, commencing with one-twenty-fourth of a grain and gradually increasing the dose. Bosworth⁴ proposes stimulation of a defective olfaction by powerful odors, frequently changed during the same day, thus forcing the nerve into increased activity by its normal stimulation.

Whilst considering olfaction, it would be well to call attention to the effects of odors at times in introducing a psychical element into the production of neurotic phenomena.

¹ Bollettino delle Malattie dell' Orecchio, etc., No. 5, 1890.

² Parosmia e sua Cura, Bollettino delle Malattie dell' Orecchio, etc., No. 1, 1887.

³ Loc. cit.

⁴ Loc. cit.

Certain odors, for example, in some individuals, whether from a peculiar mental association or from an unexplainable neurotic predisposition, have been known to produce such sympathetic reflexes as sneezing, cough, asthma, hemicrania, fainting, vomiting, and convulsions. The odors producing such effects may to the normal olfactory nerve be very pleasant, and may emanate from flowers or plants that please the eye as well as the sense of smell. Schneider¹ speaks of a suffocative catarrh from the odor of roses. Van Helmont² refers to the influence of perfumes in producing migraine, palpitation of the heart, and asthma. Cloquet³ also mentions the peculiar effects of certain odors. Cullen's⁴ case of asthma from ipecacuanha is well known. Trousseau⁵ speaks of asthma produced by the odor of violets. Ziem⁶ and others have reported similar cases.

That the fifth pair has nothing to do with the production of these reflex disturbances has been proved by the experiments of Gourewitsch and Luchsinger, who artificially caused respiratory neuroses after sections of the trigeminus and superior laryngeal. The explanation is to be found in disease or abnormal sensitiveness of the olfactory nerve filaments and bulbs, and a special irritability of the central nervous system, with a probable transference of the irritation from the olfactory to the pneumogastric through the nerve-centres, as the central connections of the olfactory are not yet clearly established. But the most important factor in their causation is probably the psychical element, and if, as Rousseau says, olfaction is the sense of imagination, we can easily appreciate how it affects our emotions and brings about alterations in the cerebral centres.

Sometimes the sight of the exciting cause, and the mental association thus brought about, may have as much to do with the vaso-motor changes as the effect of the odor. This fact is evidenced by the case of "rose-cold" produced by the sight of an artificial rose reported by John N. Mackenzie.⁷ A case in point is the following:

After the battle of Port Republic the wounded were taken into the house of the grandfather of one of my colleagues, now living in Richmond, Virginia. The honeysuckle was in full bloom, and its fragrance filled the air. My colleague's aunt was so affected by the harrowing scenes attending the care of the mangled soldiers that she was overcome and fainted. From that day until she died, years after, the odor or sight of honeysuckle brought on an attack of syncope.

Here undoubtedly the psychical element had as much to do with the vaso-motor disturbances as the impression made on the olfactory nerve by the odor of the flowers.

¹ De Catarrhis, 1662.

² Op. Omnia, Francofurti, 1682.

³ Dissertation sur les Odeurs, Paris, 1815.

⁴ Institutes of Medicine, Edinburgh, vol. i., 1788.

⁵ Clinique Médicale de l'Hôtel-Dieu de Paris, 8d ed., 1869, vol. ii.

⁶ Deutsche Medicinische Wochenschrift, No. 30, 1885.

⁷ American Journal of the Medical Sciences, January, 1886.

PART II.

REFLEX NASAL NEUROSES.

The peculiar relationship above mentioned of sundry reflex and neurotic manifestations to the nose has been a subject of much discussion in the last decade. The frequent controversies in medical assemblies, and the numerous contributions to current literature, have made it a familiar topic, and the vast accumulation of clinical evidence in support of the connection has compelled recognition of the importance of the nose as a factor in the production of various sensory, motor, vaso-motor, and trophic neuroses.

But, whilst this fact has been demonstrated beyond cavil, there is a bewildering haze enveloping much of the subject. Enthusiasm has carried some observers too far, whilst others in their extreme conservatism have taken alarm from this fact, and, shutting their eyes to the plainest kind of evidence, have denied the existence of nasal neuroses at all.

The nasal mucosa is only *one* of many points of origin of reflex effects, and, like all other probably sensitive areas, its influence has been as much over-estimated as the application of the phrase "reflex" has been abused; as, for example, the frequent use of the latter to designate functional nervous actions which arise simultaneously with sensory phenomena without any demonstration of their connection with peripheral irritation.

Physiology.—For the production of a reflex action we must have an afferent sensory nerve, an efferent motor nerve, and between the roots of these two a system of nerve cells and fibres, the "reflex centre," connecting them in the spinal cord. These are the three necessary elements of the "reflex arc." The "reflex centre" is often a complicated structure, with paths of different "resistance," which determine the form and extent of the reflex action, according to the source and intensity of the sensory impression. Not only may the sensory impulse cause a motor process, but it may pass to the brain and affect consciousness as a sensation. These reflex centres, or ganglia, are also more or less under the control of the cerebral centres (Gowers).¹

Now, as the afferent fibrillæ of each sympathetic ganglion are in reflex relationship with the efferent vaso-motor nerves furnished by it to the arteries, the brain and spinal cord, through their connection with the ganglion, are capable of transforming afferent *sensory* impulses into efferent *vaso-motor* impulses; and any impulse thus transmitted which could interfere with the nerve-control of the arteries of any special area would bring about vascular changes in the region to which they are distributed.

The medulla oblongata is the vaso-motor centre which controls the innervation of the blood-vessels; it is also the co-ordinating centre of all

¹ Diseases of the Nervous System, vol. i. p. 10.

reflex action necessary to the maintenance of life; and these physiological functions can be disturbed by the irritation of any sensory nerve of the body. The juxtaposition of the medulla with the spinal cord and all the nerve-ramifications, not only to organs of special sense, but also to the locomotive and organic systems, shows how far-reaching could be the results of any disturbance of its physiological functions.

It is only through the basal ganglia that the body has any direct nervous communication with the cerebrum and cerebellum, but there is some uncertainty about the exact mode of this communication. The correlation of the cranial nerves is not thoroughly understood; but, as far as we can make out by investigation, the sympathetic nerve-centres seem to possess a correlating nerve-function between near and distant organs (Edward Woakes).¹

For example, giddiness and tinnitus aurium from indigestion are held to be due to vascular disturbances in the labyrinth, caused by reflected irritation from the stomach to the otic ganglion (Woakes). Irritation of the larynx and cough from foreign bodies in the ear, and earache from ulceration of the larynx, are supposed to be caused by sympathetic irritation through the same ganglion.

Whilst this may be so, there is an element of uncertainty in these explanations, because of the different results from physiological experiment. Claude Bernard found that tearing away the spheno-palatine ganglion caused a serous flow like that accompanying coryza. He also found sensibility to persist in the nasal mucous membrane after section of the naso-palatine branches of this ganglion. Prévost found that extirpation of the ganglion was not followed by any alterations either in nutrition or in vascularization of the nasal mucous membrane, and that, as stated by Bernard, the sensibility remained intact. Aschenbrandt² found that extirpation of the ganglion produced a congestive condition, whilst irritation caused turgescence of the inferior turbinate and the vessels of the septum became injected. There is at first hyperæmia, followed by a mucous and muco-purulent discharge. Prévost found also that galvanization of the ganglion produced a flow of mucus from the same side. He, moreover, observed that irritation of the superior cervical ganglion produced no result whatever. This was confirmed by Aschenbrandt, who discovered no change in the nasal mucous membrane even after extirpation of the cervical sympathetic.

These experiments show that the trigeminus is the nerve controlling the secretion, and possibly the nutrition, of the nose, but do not demonstrate that its ganglia are centres of reflex action. Nothing has yet been adduced to support this view, except theoretic reasoning. It is through the trigeminus, however, that we are to look for the production of the so-called nasal reflexes, both physiological and pathological. It is among the most

¹ Correlating Function of the Sympathetic Ganglia, Transactions of the International Medical Congress, London, 1881.

² *Monatsschrift für Ohrenheilkunde*, No. 3, 1885.

important of the cranial nerves, because of the large territory it innervates, of its numerous anastomoses with the sympathetic (the ophthalmic ganglion, Meckel's ganglion, and the cavernous plexus), and of the spread of its roots to the bulbar spinal apparatus, where it is connected with all the nerves that have their origin in the medulla oblongata.

Its rich ganglionic connections, and the important functions over which the trigeminus presides, make it extremely probable that any irritation, whether local or reflected, of its terminal ends in the nasal mucous membrane, or elsewhere, can produce various phenomena not only in the parts directly under control of the nerve and its branches, but also in parts innervated by any of its ganglionic connections.

The peculiar construction of the intra-nasal tissues makes them exceedingly sensitive to irritation, not only applied locally, but reflected to them from other parts. The presence of vascular tissue analogous to similar tissue in the genital organs, the erectile character of which was first noticed by Cruveilhier,¹ and to which Professor Bigelow,² of Boston, gave the name of "turbinate corpora cavernosa," explains its excessive irritability. Kohlrausch³ (1853), Zuckerkandl,⁴ E. Fraenkel,⁵ John N. Mackenzie,⁶ Isch-Wall,⁷ L. Arviset,⁸ Herzfeld,⁹ and others, by further investigation and description of this tissue, have added to our knowledge. With few exceptions, most writers of this day admit its erectile nature.

According to Zuckerkandl, it is not limited to the turbinated bodies, but is found in all parts of the nasal mucosa except the olfactory fissure. This intra-nasal tissue, being obliged to adapt itself to constantly-changing thermal and atmospheric conditions, is provided with a regulating mechanism to correlate and control the glandular and vascular supply by the trigeminus, and especially by the branches of the sphenopalatine ganglion. The sensitiveness of this tissue is proved by its resentment of the slightest irritation, whether direct or indirect, manifested by the physiological movements produced by such irritation.

The most common and best-known of these reflexes are sneezing and lachrymation. Direct irritation of the mucous membrane of the nose can usually produce lachrymation and sneezing, with congestion and swelling of the erectile tissues followed by secretion. Kratschmer¹⁰ has shown that temporary arrest of the heart's beats can be caused by irritation of the nose.

¹ *Traité d'Anatomie Descriptive*, 1845, t. iv. p. 55.

² *Boston Medical and Surgical Journal*, April 29, 1875.

³ *Archiv für Anatomie, Physiologie, etc.*, 1853.

⁴ *Wiener Medicinische Wochenschrift*, No. 38, 1884.

⁵ *Deutsche Medicinische Wochenschrift*, No. 18, 1884.

⁶ *Historical Notes on the Discovery of the Nasal Erectile Tissue*, *Boston Medical and Surgical Journal*, January, 1885, and *loc. cit.*

⁷ *Le Progrès Médical*, September, 1887.

⁸ *Thèse*, Lyon, August, 1887.

⁹ *Züricher Centralblatt*, No. 20, September 15, 1890.

¹⁰ *Sitzungsberichte d. Akademie der Wissenschaften, Wien*, 1870.

Lazarus¹ has produced increased pressure in the bronchi in the same way. As the pressure did not increase after cutting the vagi, it could come only from decreasing the lumen of the bronchi. These reflexes can also be produced indirectly, as, for example, sneezing follows irritation of the retina by a strong light.

Such phenomena differ somewhat in different individuals, as I have found by experiment made upon myself and others. If I irritate my intra-nasal tissues it takes some time to produce any reflex whatever, but the first to be manifested is lachrymation on the side irritated, followed by evident swelling of the corpora cavernosa and by a serous exudation: cough I cannot produce at all. On the contrary, if I sit in a warm room with my back to an open door or window, I will begin to sneeze almost before I am aware of the draught of cooler air. I have observed the same effect in others, whilst in some, artificial irritation of the nose will cause sneezing immediately, and in nearly all such individuals continuance of the irritation will cause cough.

Hence I conclude that the sensitive areas localized by John N. Mackenzie² in the domain of the nasal branches of the sphenopalatine ganglion do not invariably exist, but are peculiar to certain individuals only. L. Lichtwitz³ also located similar irritable zones in the nasal spaces, but his subjects were cases suffering from nervous disorders, such as hysteria, etc.

This sphenopalatine ganglion, which gives off branches to the nasal mucosa, is in direct connection with the Gasserian ganglion at the sensory root of the trigeminus, which is connected with the carotid plexus of the superior cervical ganglion of the sympathetic, and with the pneumogastric, the fibres of which are distributed to the larynx, lungs, heart, œsophagus, stomach, and intestines. We have also the otic, the ophthalmic, the maxillary, and the superior and inferior dentals, all united in common through the sympathetic, giving a rich field of nervous net-work in any part of which the transmission of any irritation sufficient to disturb its normal physiological function could produce neurotic phenomena. The pathological reflex manifestations that have been supposed to emanate from peripheral irritation of the nasal branches of this complex nervous communication are almost legion. The first to which attention was particularly directed was asthma; and following this observation came many other clinical reports of different neuroses, apparently dependent upon nasal disorder, and cured by the treatment of the nasal affection. They comprise sensory, motor, vaso-motor, and trophic neuroses of various organs, as follows:

Of the eye, conjunctivitis, keratitis, phlyctenular ophthalmia, chemosis, glaucoma, asthenopia, muscæ volitantes, etc. *Of the ear*, tinnitus, pain,

¹ Archiv für Anatomie und Physiologie, Hefte 1 und 2, 1891.

² On Nasal Cough and the Existence of a Sensitive Reflex Area in the Nose, American Journal of the Medical Sciences, July, 1893.

³ Revue Mensuelle de Laryngologie, etc., December, 1886.

itching of the external meatus, snapping noises (Burnett), spasmodic action of the tensor tympani, etc. *Of the nose*, spasmodic sneezing, hyperæsthesia, hydrorrhœa, perversion or depreciation of the olfactory sense, epistaxis, erythema, acne of nose, cough, etc. *Of the pharynx*, paræsthesia, sensation of foreign body, neuralgia, dysphagia, and paresis of palate muscles. *Of the mouth*, herpes, salivation, and toothache. *Of the larynx*, aphonia, cough, and laryngeal spasm (croup). *Of the bronchi*, asthma and bronchitis. *Of the gastro-intestinal tract*, irritation, dyspepsia, etc. *Of the skin*, erythema, acne, herpes, urticaria, erysipelas, œdema, localized perspiration, etc. *Of the heart and circulation*, cardialgia, palpitation, symptoms closely resembling angina, and exophthalmic goitre. *Of the muscles*, rheumatic pains, spasmodic twitchings, convulsive movements choreiform in character, etc. *Of the brain and nervous system*, hemicrania, migraine, neuralgias of the trigeminus, epileptiform seizures, etc., loss of memory, inability to fix the attention (aproxesia), melancholia, neurasthenia, etc.

Whilst the above neurotic manifestations accompanying or dependent upon irritation of the nose and naso-pharynx have been reported by numerous authors as the result of their clinical observation, it must be said that the connection between the supposed cause and the apparent effect has not been satisfactorily demonstrated in many instances, and there is no doubt that the enthusiastic rhinologist has been frequently led into the error of confounding cause and effect because of the coincident appearance of the two affections in the same subject. Because a patient has pathological alterations in the nasal fossæ and at the same time is a victim of some respiratory or other neurosis, it does not follow that one is a sequence of the other. It is quite common to find asthma, bronchitis, etc., clinically associated with intra-nasal changes, without being dependent upon the latter, even where there may be a positive nasal reflex, such as cough, already manifested.

In the last year, such a case presented itself to me in the person of one of my colleagues, who had had for some time a cough evidently due to some pathological condition in the nose, and which was much improved by the treatment of the latter. The subsequent advent of asthmatic attacks he was disposed to attribute to the same cause, because of the presence of an abnormality of the septum, with some turgescence of the turbinates in the left nostril; and, although he wished me to operate, I declined, on the ground that the asthma was due to other causes than nasal irritation, and the further developments in the case justified me in this conclusion.

Historical Notice.—To Voltolini may justly be attributed the credit of awakening modern attention to the subject of nasal reflex neuroses, by his article "Ueber die Anwendung der Galvano-Kaustik" (Wien, 1871), demonstrating that asthma often resulted from, and was cured by the removal of, nasal polyps. But the fact that respiratory and other neuroses were sometimes of nasal origin was known long before this accomplished rhinologist gave his clinical experience to the world.

John N. Mackenzie¹ has shown that this relationship was recognized almost from the earliest ages of medicine. His paper is sufficiently interesting to be quoted in full, if space permitted; but only a brief synopsis can be here presented. He has, with considerable labor and research, found references to the interdependence of the nose and various neuroses, such as asthma, syncope, epilepsy, periodic coryza, affections of the eye, ear, stomach, and skin, hoarseness, headache, vertigo, troubles of the sexual apparatus, etc., in the works of many authors in different ages.

In the writings of Plato, Hippocrates, Aristotle, and Galen he has pointed out passages indicating at least a suspicion of the connection between the nose and certain neurotic phenomena.

Many refer to the association of coryza with sneezing, migraine, asthma, etc. Ferber advanced the theory that these phenomena were the expression of a neurosis of the trigeminus,—a view advocated by more recent writers.

The possibility of some connection between irritation of the nose, or sneezing, and epileptiform seizures seems to have been considered for ages, as is gleaned from the writings of Aretæus, Pliny, Avicenna, Fernelius, Salmuth (1648), Van Helmont (1682), and others.

Fernelius (1668) also speaks of hemicrania in connection with catarrh, and of a relation between suppression of urine and nasal catarrh. Van Helmont, as already stated, refers especially to the effects of odors in the production not only of epilepsy, but also of sneezing, vertigo, headache, cough, asthma, palpitation, and fainting. Johann Jacob Wepfer, in a work published in 1728, distinctly enunciates the relationship of hemicrania and other pathological phenomena to nasal inflammation and obstruction, and concludes that these neuroses are due to a turgescence of the myriad vessels of the spongy bodies (*corpora spongiosa*).

Robert Whyte, in his work on nervous diseases, refers to fits being caused by the smell of musk, ambergris, etc. He also in this book (a fact overlooked by Mackenzie in his article) refers to the relationship of the nose and cough, and advises the inhalation through the nose of Hungary water and other volatile agents to check cough.

The relationship of the stomach and coryza was discussed by Schroeder and May. Many of the older writers treat of the effects of odors, etc., on the nose in producing syncope, hemicrania, etc. Bartholini (1761), Gruner (1801), and others refer to the sympathy between the nose and the sexual organs. Deschamps ascribed hemicrania to disease of the frontal sinus, and Portal reported cases of pain, vertigo, and epileptiform convulsions in connection with diseases of the nasal membranes.

These references to the nasal reflex show that the nose was recognized as a ready focus of peripheral irritation from which neurotic phenomena

¹ The Pathological Nasal Reflex: a Historical Study, New York Medical Journal, August 20, 1887.

could emanate long before Voltolini's observations gave a positive and definite aspect to the question by the cure of his cases by intra-nasal treatment alone. His results were soon confirmed by a host of articles from different authors.

Whilst most authors have dealt especially with the production of asthma by intra-nasal changes, some have called attention to other reflexes from the same causation. Fraenkel speaks of cough from nasal disease, Löwe, of epilepsy due to nasal irritation, Hartmann, of supra-orbital neuralgia, and Seiler, of conjunctivitis, as reflexes from the nose. Seiler¹ also reports two cases of cough of similar origin.

The paper of Daly, of Pittsburg, on "Hay-Fever and Nasal Catarrh," presented to the American Laryngological Society in 1881 and published in the *Archives of Laryngology* in 1882, was a most valuable contribution to this subject, inasmuch as its author called the attention of the profession for the first time to the importance of intra-nasal irritation as a factor in the production of hay-fever.

Of all publications on this subject Hack's² article and his subsequent publications attracted most wide-spread attention, because they were more general and more comprehensive in dealing with nasal reflexes.

He reported cases of spasmodic sneezing, asthma, cough, supra-orbital and ciliary neuralgia, cephalalgia, pain and swelling of the eyelids, *muscæ volitantes*, glottic spasm, and epilepsy, which he asserted, after the most careful clinical investigation, were due to pathological changes in the nasal tissues, and were cured by the destruction of the nasal irritability with the galvano-cautery.

In this and subsequent articles³ he enunciated his theory of nasal reflexes, which in the main was as follows, although he subsequently modified his views in some particulars :

Following irritations of the nasal mucous membrane from whatever cause (whether extra-nasal, from atmospheric or thermal influences, or irritation of nerves of special sense, or of the skin; or intra-nasal, from polyps, spurs of the septum, adhesions, etc.), the erectile bodies become engorged, especially the anterior portion of the inferior turbinate.

The resulting tension of the mucous membrane covering the cavernous bodies causes irritability of the sensitive nerve filaments of the mucosa, thus starting the train of reflex phenomena.

He asserted that turgescence of the turbinates was the essential connecting link between the nasal irritation and the reflex manifestations, and

¹ *Archives of Laryngology*, 1882.

² *Berliner Klinische Wochenschrift*, xix., 1882.

³ Ueber die Entstehung von exudativen sogenannten rheumatischen Processen vor der Nasenschleimhaut aus, *Fortschritte der Medicin*, No. 20, 1883; Ueber Reflex Neurosen die von der Nase ausgehen, *Tageblatt der Versammlung Deutscher Naturforscher und Aerzte*, Magdeburg, 1884; Ueber eine operative radical Behandlung bestimmter Formen von Migraine, Asthma, Heufieber, etc., *Wiesbaden*, 1884; and *Erfahrungen auf dem Gebiete der Nasenkrankheiten*, Wiesbaden, 1884.

that, as inflammatory action interfered with engorgement of the cavernous tissue, the production of reflexes was in inverse ratio to the extent of the inflammation. The causes of this turgescence in the mucosa itself are due to reflex influences more or less distant. Hack's are among the most valuable articles in the literature of the nasal reflex, and his work gave a great incentive to the close study of the subject.

In 1883 and 1884, in addition to Hack's contributions, articles appeared from Elsberg¹ and others.

Among these writers, whilst the majority agreed with Hack that the pathological condition of the intra-nasal tissues was the essential factor in the etiology of nasal reflexes, and that any accompanying neurasthenia was secondary to the nasal affection, there were some points of difference from his views.

The investigation of E. Fraenkel seemed to prove that the turbinated hypertrophy was the result of a chronic inflammatory process (chronic rhinitis) which caused thickening of the mucosa over the turbinates, thus controverting Hack's proposition above referred to in regard to inflammation.

According to Fraenkel, Schnitzler, Schaeffer, and others, this chronic rhinitis was the starting-point of the nasal alterations which brought about reflexes. John N. Mackenzie, however, radically differed from these authors. His paper on nasal cough is an original production in its attempt to locate a special sensitive area in the nose, the artificial irritation of which could produce sneezing, lachrymation, cough, etc., this zone being more particularly confined to the middle turbinate and posterior portion of the inferior turbinate, and the septum opposite the part dominated by the sphenopalatine branches of the superior maxillary nerve. Mackenzie's conclusions in regard to the reflex area were endorsed by Roe, Longuet,² and others.

Hack, on the contrary, in his earlier writings was inclined to limit the irritable zone to the anterior portion of the inferior turbinate, and thought that reflexes arising from stimulation of other portions of the nostril occurred secondarily through congestion of the erectile tissue of this locality.

But, whilst Hack held that the point of greatest excitability was the terminal filaments of the nerves of the nasal mucosa, Mackenzie, in his scholarly article on "*Coryza Vaso-Motoria Periodica*,"³ and in subsequent publications,⁴ took the ground that reflexes arising from the irritation of this sensitive area (asthma, cough, etc.) are due to a certain excitability of the reflex or vaso-motor centres, but that such reflex phenomena cannot take place without engorgement of the turbinated tissue, the mainspring of the machinery that puts the pathological process in motion.

The repeated irritation of the nasal erectile tissue, either from extraneous

¹ Reflex and other Phenomena due to Nasal Disease, *Archives of Laryngology*, 1883.

² *L'Union Médicale*, January, 1884.

³ *American Journal of the Medical Sciences*, July, 1884.

⁴ *Rhinitis Sympathetica*, *Maryland Medical Journal*, April 11, 1885.

influences or from internal causes, by keeping up constant vascular disturbances, can result in a hyperæsthetic condition of the nerve-centres which will express itself in a paroxysm, the constant excitation of the centres by the peripheral irritation having so altered their reflex excitability that they respond more readily to reflex-producing impressions. This derangement of the nervous apparatus may also be due to inherited diatheses, such as gout, rheumatism, scrofula, herpes, etc., or to any general faulty condition of the system, or to reflected irritation from other parts of the body, as from the gastro-intestinal or the genito-urinary organs.

In individuals thus affected, whose nerve-centres are in a state of abnormal excitability, any increase of peripheral irritation would cause an explosion of some neurotic manifestation, and the respiratory tract, being more exposed to external influences than any other part of the economy, would naturally be more subject to vascular disturbances that could be the starting-point of such neuroses.

For elaboration of Mackenzie's views the reader is referred to his articles mentioned in this notice, as they are among the most valuable contributions to this subject.

In my address¹ before the American Medical Association, May, 1885, I took the ground that Mackenzie's views in this particular were correct, for, as he says, "it is a more comprehensive explanation of the varied phases assumed by these reflexes, to suppose a disordered functional condition of the nerve-centres as against organic alterations of the peripheral sensitive nerves, for upon this theory can be explained the occurrence of similar neuroses from irritation reflected from various parts of the body remote from the nasal passages." But I was inclined to differ from Mackenzie in the limitation of the reflex-producing power of the nasal mucosa to any special area, as from clinical experience I was familiar with reflex manifestations without engorgement or hypertrophy of the erectile tissue,—*e.g.*, reflex cough accompanying atrophic rhinitis.

Hopmann² has reported a case of asthma, and Bosworth³ one of glottic spasm, as reflexes from the nose in the same disease. Subsequently Barataux⁴ and Heryng⁵ asserted that the special sensitive part of the nasal fossæ was the septum, and that reflexes arose from irritation of the latter by the swollen nasal tissues, or any other cause that could stimulate the mucosa over the septum. B. Fraenkel,⁶ Schaeffer,⁷ Hopmann,⁸ Schmaltz,⁹ and

¹ Journal of the American Medical Association, June 21, 1885.

² Fifty-Seventh Reunion of German Naturalists and Physicians, 1884.

³ Archives of Laryngologie, vol. iv. p. 289.

⁴ Revue Mensuelle de Laryngologie, etc., December, 1885.

⁵ Annales des Maladies de l'Oreille, du Larynx, etc., February and March, 1886.

⁶ Congrès International, Copenhagen, 1884.

⁷ Chirurgische Erfahrungen in der Rhinologie, Wiesbaden, 1885.

⁸ Fifty-Eighth Reunion of German Naturalists and Physicians, September, 1885.

⁹ Berliner Klinische Wochenschrift, Nos. 29 and 32, 1885.

others denied the necessity of engorgement of the turbinated tissues in the production of reflexes.

Tornwaldt and others have shown that various reflexes, such as cough, headache, asthma, tinnitus aurium, etc., are produced by the presence of adenoid tissue at the vault of the pharynx and cured by its removal.

From these opinions it would seem that all parts of the nasal mucosa are capable under certain conditions of exciting reflex neuroses, as maintained by Roth.¹ Accompanying or following the able contributions of Hack and Mackenzie on this subject were a host of publications from different authors who agree with these writers on some points and differ on others. Fraenkel,² Schaeffer,³ Roth,⁴ Schmaltz,⁵ Schech,⁶ Boecker,⁷ Cartaz,⁸ and Ruault⁹ agree that reflex neuroses are due to a state of excitability of the sensitive fibres of the nasal mucosa, and that they can arise from any part of it without the intervention of turbinated engorgement.

Rosbach,¹⁰ Lublinski,¹¹ Heymann,¹² and others consider a neurotic predisposition a *sine qua non* for the production of a reflex phenomenon by nasal irritation.

Schreiber¹³ does not believe in nasal reflexes. He considers the turbinated engorgement accompanying certain neuroses as an accidental complication, or a vaso-motor trouble due to the neurosis itself, and the favorable effects of cauterization as a piece of luck or an effect due to the revulsive action of the cautery. This view was held by Gottstein¹⁴ and a few others.

These different views in regard to nasal reflex neuroses will be discussed when the etiology is considered.

Classification.—It is a difficult matter to make a satisfactory classification of reflex nasal neuroses, because many of them are of a complex character; but the least unsatisfactory is probably a division into sensory, motor, vaso-motor, and trophic neuroses. For convenience we may also separate them into neuroses of the respiratory tract, and neuroses affecting other parts of the body.

RESPIRATORY NEUROSES.

We will deal first with neuroses of the respiratory tract, such as hyperæsthesia, sneezing, cough, laryngo-spasm, aphonia, asthma, etc., or reflex

¹ Wiener Medicinische Wochenschrift, Nos. 16 and 17, 1885.

² Loc. cit.

³ Loc. cit.

⁴ Centralblatt für die Gesamte Therapie, No. 21, 1887.

⁵ Loc. cit.

⁶ Die Krankheiten der Mundhöhle, des Rachens und der Nase, 2d ed., Wien, 1888.

⁷ Deutsche Medicinische Wochenschrift, Nos. 26 and 27, 1886.

⁸ La France Médicale, Nos. 89 and 90, 1885.

⁹ Gazette des Hôpitaux, December, 1887.

¹⁰ Die Nase in ihren Beziehungen zum übrigen Körper, Jena, 1885.

¹¹ Deutsche Medicinische Zeitung, No. 41, 1886.

¹² Ibid., No. 66, 1886.

¹³ Berliner Klinische Wochenschrift, No. 33, 1885.

¹⁴ International Congress, Copenhagen, 1884.

manifestations in the nose, naso-pharynx, pharynx and mouth, larynx and bronchial tubes.

Some authors, notably J. N. Mackenzie,¹ divide these also into physiological and pathological reflexes. Under the former heading are comprised sudden and temporary engorgement of the nasal tissues, sneezing, increased secretion from the nose, lachrymation, and cough. Through any irritation of the nose by artificial means, or by dust or by sudden chilling of the surface, these reflexes can be developed in many, if not all, individuals.

Even if they can be produced by artificial means, such as irritation with a probe, etc., I do not think they can all, particularly cough, be denominated physiological reflexes, because any prolonged irritation in the nasal passages by a probe or other artificial means will, if continued long enough, bring about a pathological condition of the intra-nasal circulation that would result in irritability of the nerve-filaments, just as would the presence of a foreign body or a chronic inflammation.

If all these reflexes are produced very readily in some individuals and only after a considerable effort in others, it probably shows that the former class possess an irritable nose, ready to resent any unaccustomed interference, and is in many cases an evidence of neurotic habit.

This same reasoning holds good with the pharynx. Every one who is accustomed to examine the throat knows that in a healthy pharynx there is no trouble in using the tongue-depressor in the mouth or touching the pharynx with a probe. But frequently when the latter is pathologically altered a tongue-depressor will cause gagging, and the contact of a probe or foreign body in the throat, cough and retching. This is known as "irritable throat," and is hardly a physiological condition. Persons with special irritability of the nasal tissues are prone to functional disturbances, such as sneezing, swelling, secretion, etc., or the so-called physiological reflexes, which are also at times symptoms of a pathological state known as *hyperæsthesia*.

HYPERÆSTHESIA.

If they are purely physiological, why is it that persons with the same condition of the nasal tissues, exposed to the same surroundings and the same presumable irritation, do not manifest the same phenomena? I think the explanation lies in the difference in their nervous organization, a functional disturbance of the nerve-centres being present in some cases and not in others. A hyperæsthetic condition of the nasal mucous membrane can result from any irritation due to catarrhal inflammation or other local pathological alteration, or from central causes, or may be reflected irritation from distant organs, as from troubles of the eye, the ear, or the respiratory, digestive, or genital apparatus. In mild cases there is a tendency to temporary obstruction of one or both nostrils from vaso-motor disturbances,

¹ Reference Hand-Book of the Medical Sciences, vol. v. p. 222, 1887.

especially when lying down. The nostrils on the side lain on will become somewhat stuffy, and if the patient turns over that side becomes clear and the other side obstructed. It is easy in such cases artificially to produce sneezing, flow of serum from the nose, and even cough.

This tendency to vaso-motor alteration in the nose, sometimes attended by other symptoms of hyperæsthesia, such as sneezing, etc., frequently accompanies the general nervous disturbances caused by the function of menstruation, and although occurring during a physiological epoch it is not necessarily a physiological phenomenon. It is more likely analogous to nervous coryza (Peyer),¹ or to sympathetic rhinitis, so ably portrayed by John N. Mackenzie,² the hyperæsthesia of the nasal erectile tissue participating in and sympathizing with the disturbances of the corresponding tissue in the sexual apparatus. Sneezing, which is the most common of nasal reflexes, is a symptom of hyperæsthesia.

STERNUTATION.

The literature of nasal reflexes is filled with reports of cases of what may be called paroxysmal or spasmodic sneezing accompanying intra-nasal alterations, by Mackenzie,³ Hack,⁴ Sommerbrodt,⁵ Schmiegelow,⁶ Sidney Ringer, W. Murrell,⁷ and others. But paroxysms of sneezing so long continued or of such frequent occurrence as to endanger life, or similar paroxysms of constant repetition without any pathological alterations of the nasal fossa, are not common.

Cartaz⁸ reports several cases of sneezing with sense of suffocation without any perceptible alteration of the nasal mucous membrane; Ch. Féré,⁹ one case with constant paroxysms, sneezing thirty to forty times a minute, which he ascribed to hysteria; Bobone,¹⁰ a case of a girl eight years old, recovering from some skin-trouble, who was seized with violent sneezing which at each attack continued until syncope resulted (in this case there was a swelling of the inferior turbinates, and flow of serum from the nose); Munk,¹¹ a case cured by cocaine; J. Solis Cohen,¹² one case who suffered from uncontrollable attacks of sneezing with dyspnœa at any time of the year, the nasal spaces being perfectly normal (the attacks were accompanied by sensations of tickling in the nose, burning in the eyes, lachrymation, and

¹ Loc. cit., also *Münchener Medicinische Wochenschrift*, Nos. 3 and 4, 1889.

² *Maryland Medical Journal*, April 11, 1885.

³ Loc. cit.

⁴ Loc. cit.

⁵ *Berliner Klinische Wochenschrift*, Nos. 10 and 11, 1885.

⁶ *Hospitals Tidende*, March, 1885.

⁷ *Remarks on Paroxysmal Sneezing*, *British Medical Journal*, June, 1888.

⁸ *La France Médicale*, August, 1885.

⁹ *Le Progrès Médical*, January, 1885.

¹⁰ *Bollettino delle Malattie dell' Orecchio, della Gola, etc.*, Anno IV., No. 4, p. 76.

¹¹ *Wiener Medicinische Presse*, No. 51, 1886.

¹² *A Case of Hysterical Sneezing*, *New York Medical Journal*, January, 1887.

flow of serum from the nose); Robert J. Lee,¹ a singular case of sneezing and yawning caused by the drawing of a tooth; Fenykövy,² a case of a girl twenty-two years old who had for seven years had violent attacks of sneezing every day, and who had perfectly normal nasal fossæ and no other nervous manifestations; De Rechter,³ a case who sneezed thirty to forty times a minute repeated during days (there was pain on pressure over the left ovary); Raugé,⁴ four cases with itching, tickling, pain, etc., without any deviation from the normal conditions of the skin or nasal mucosa. Trifilletti⁵ and others have made similar observations. The cases here recorded as nasal reflexes without pathological alterations of the intra-nasal tissues are examples of hyperæsthesia of the nose due to irritation transmitted to the sensory and trophic nasal nerves from other parts of the organism, more or less distant, and are evidences of a neurotic disposition, with impaired vitality of the central nervous system.

In my own experience I have met cases who complained of attacks of sneezing coming on suddenly at any time, followed by pain in the bridge of the nose and over the eye, which they described as similar to the pain brought on by eating ice-cream too rapidly. Sometimes these attacks are preceded by a stuffy feeling about the nose, and end in a discharge of watery fluid; but these symptoms are not constant. In these cases a careful examination of the nose anteriorly or in the post-nasal space revealed no abnormality, not even engorgement. The attacks seem to come on without any apparent cause, and I have supposed the explanation to be in a highly irritable condition of the nasal mucosa, rendering it liable to resent the contact of the slightest dust or other atmospheric particles, and in a corresponding irritability of the vaso-motor centres from lowered vitality. Where such conditions for the production of reflexes exist, the irritation may be transmitted from distant organs, as in Romberg's⁶ case of sneezing during coitus.

Hydorrhœa, or a discharge of watery fluid from the nose, has been reported as secretory neurosis of the nose. Dr. Bosworth in his able work on Diseases of the Nose and Throat⁷ has collected eighteen cases of this trouble, and the reader is referred to them for the history, etc.

COUGH.

When John N. Mackenzie⁸ published his paper on nasal cough in 1883, and directed attention to the great frequency of cough as a reflex from the

¹ Medical Press and Circular, January, 1888.

² Coryza Spasmodica, Internationale Klinische Rundschau, No. 47, 1889.

³ Journal de Médecine, de Chirurgie et de Pharmacie, No. 4, 1889.

⁴ Lyon Médical, March, 1890.

⁵ Archivij Italiani di Laringologia, April, 1890.

⁶ Diseases of the Nervous System, Sydenham Society Transactions.

⁷ Vol. i., The Nose and Naso-Pharynx, p. 258.

⁸ American Journal of the Medical Sciences, July, 1883.

nose, which could be relieved by the treatment of the nasal affection, he marked a new era in the etiology of reflex or nervous cough. For, although others before him had recognized the connection between nasal diseases and cough, its importance had not received the consideration it merited. The mental anxiety caused by chronic cough to the sufferer and his friends, because of its possible significance in relation to pulmonary disease, makes it a subject of grave interest, and any elucidation of its etiology is an advance in regard to its treatment.

Much has been written about hysterical, nervous, and convulsive cough. It has been traced to irritation of the intestinal tract, as from worms (R. J. Graves);¹ to diseases of the genital apparatus, the so-called uterine cough (Paul Müller);² to irritation of the ear from impaction of wax and other foreign bodies,—ear-cough; to irritation of the larynx; and to constitutional conditions, such as lithæmia (Whitehall Hinkel),³ etc.; but the most frequent cause of reflex cough is some pathological change in the naso-bronchial mucosa. This connection was referred to by Hérard⁴ (quoted by Troussseau), who reported a case of hysterical cough which alternated with irregular spasms of sneezing; by Lasègue,⁵ whose case had constant cough accompanying a simple coryza, which disappeared with the cure of the cold; and by others without any comment on the causation. Hack⁶ reported a case of spasmodic cough caused by nasal polyp, and Seiler⁷ two cases dependent upon nasal disease, and cured by the treatment of the latter; but Mackenzie was the first to demonstrate the fact that cough was frequently dependent upon intra-nasal disease, and could be produced by artificial irritation, even when there was no apparent pathological alteration in the nasal tissues.

As already stated, he was of the opinion that this result was due to the existence of specially sensitive areas in the nose (cough area), in the parts dominated by the nerve-filaments from the spheno-palatine ganglion, and that the physiological explanation of the phenomenon was found in the doctrine of correlated areas (Woakes),⁸ the reflex taking place through the vaso-dilator nerves from the superior cervical ganglion of the sympathetic. Longuet,⁹ Cresswell Baber,¹⁰ Schmaltz,¹¹ Sommerbrodt,¹² Ensing,¹³ Schmiede-

¹ Lessons of Clinical Medicine, 2d ed., London, 1863.

² De la Toux Utérine, Thèse, Paris, July, 1887.

³ Some Manifestations of Lithæmia in the Upper Air-Passages, Transactions of the American Laryngological Society, 1889.

⁴ L'Union Médicale, 1864.

⁵ Mémoire sur la Toux Hystérique, Archives Générales de Médecine, 1854.

⁶ Berliner Klinische Wochenschrift, No. 25, 1882.

⁷ Archives of Laryngology, etc., vol. iii. p. 240, 1882.

⁸ Loc. cit., and Diseases, Giddiness, and Noises in the Head, London, 1880.

⁹ L'Union Médicale, January, 1884.

¹⁰ British Medical Journal, November, 1884.

¹¹ Loc. cit.

¹² Berliner Klinische Wochenschrift, 1884.

¹³ Weekblad van het Nederlands. Tijdschrift voor Geneeskunde, No. 22, 1885.

low, Rethi,¹ Cartaz,² Wille,³ Schadewaldt,⁴ Heryng,⁵ Schech,⁶ Scheinmann,⁷ Tornwaldt,⁸ Lublinski, Lichtwitz,⁹ Schadle,¹⁰ and others reported cases of cough due to and cured by treatment of nasal diseases. Wille and Schadewaldt consider the cough a modification of the so-called physiological nasal reflex sneezing. According to them, the physiological reaction of the nasal mucosa from irritation is swelling, sneezing, secretion. In the pathological condition the swelling alone shows itself, there is coryza without sneezing, and the cough takes the place of the latter. It is frequently of extreme violence, resembling at times whooping-cough, and is due to irritation of the terminal filaments of the trigeminus.

Nasal cough can be caused by simple coryza, hypertrophic rhinitis, spurs and deflection of the septum, polyps, hypertrophy of the cavernous tissue over the vomer, adenoid growths at the vault of the pharynx, etc. In my own experience I have seen a large number of cases of nasal cough, caused by almost every pathological condition in the nasal spaces that could cause a local irritation, although hypertrophy of the middle turbinate seems the most constant change and corresponds with the results of the investigation of François Franke.¹¹ Simple vaso-motor changes in the nose also produce it. Whether the irritation is transmitted to the pneumogastric through its sympathetic ganglionic connections, or by the trigeminus through the basal ganglia (the bulbar theory of reflex production), is a matter for future investigation when we know more of the cranial and the sympathetic nerves. But the fact that cough is often thus reflexly produced is of great clinical value in diagnosis.

Its constant occurrence in the early stages of pulmonary disease makes it all-important that the physician should examine into the possibility of its being of reflex origin, and especially as emanating from the pharyngo-nasal spaces. I have seen cases whose life was a burden to them because of a cough which was supposed to be the advance-guard of phthisis, who were dragged from their homes every winter to Florida, Colorado, and other resorts for the phthisically disposed, who had to sacrifice home comforts,

¹ Wiener Medicinische Presse, Nos. 37, 38, and 39, 1886.

² Loc. cit.

³ Der Trigeminiushusten, Deutsche Medicinische Wochenschrift, Nos. 16 and 17, 1885.

⁴ Die Trigemini-Neurosen, Deutsche Medicinische Wochenschrift, Nos. 37 and 38, 1885.

⁵ Loc. cit.

⁶ Loc. cit.

⁷ Berliner Klinische Wochenschrift, Nos. 14, 15, 19, and 21, 1889.

⁸ Ueber die Bedeutung der Bursa pharyngea für die Erkennung und Behandlung gewisser Nasenrachenraum-Krankheiten, Wiesbaden, 1885.

⁹ Neuroses d'Origine nasale et pharyngée, Annales des Maladies de l'Oreille, du Larynx, etc., December, 1889.

¹⁰ Cough in its Relations to Morbid States of the Nasal Passages, Journal of the American Medical Association, March 1, 1890.

¹¹ Archives de Physiologie, July, 1889.

business, and everything else that makes life pleasant, to keep from dying, when the trouble was a simple reflex one. I have cases of this kind on my record-book, who were brought to me to see if the larynx was showing any signs of phthisis, and in whom an examination of the nose revealed the origin of the trouble.

Sometimes a cough of years' standing has been cured in a few days or weeks by the appropriate treatment of the nasal disease. In the last few months I have seen a lady who has had an annoying cough for three years, causing her great anxiety and alarming her family. In one week this three years' cough was cured by the nasal treatment; and this is only one of many such.

I doubt if to-day the importance of the relation is appreciated by most practitioners of medicine. Important as it is, it is only one of many causes, outside of pulmonary diseases, that can produce cough. But it is a frequent cause, and should not be overlooked in the elucidation of seemingly so grave a trouble and one so harassing to the sufferer.

Every physician when a cough has proved intractable to ordinary treatment and he is satisfied that there is no pulmonary lesion, as far as the means of diagnosis enable him to determine, should examine the nasal spaces. If any pathological condition exists, if the intra-nasal tissues are irritable, there is a probability that the cough is of nasal origin. Sometimes the local application of a solution of cocaine will temporarily ameliorate the attack of coughing. Sometimes cough can be produced by artificial irritation of the intra-nasal tissues. In either case the diagnosis of "nasal reflex cough" would be demonstrated. But even if the cocaine test fails, even if the cough cannot be produced by artificial irritation, it does not follow that it is independent of an existing pathological condition of the nose.

I have seen cases where both these tests failed and yet the cough disappeared with the restoration of the normal symmetry of the nasal spaces. But the treatment should be directed not only to the local nasal trouble, but also to the improvement of the general nervous system (as well as other reflex phenomena), as without some functional alterations of the nerve-centres, whether of the sympathetic or of the basal ganglia, there could be no manifestation of reflex phenomena.

PHARYNX AND MOUTH.

Reflex effects of intra-nasal disease in the pharynx and mouth, reported by some writers, are hyperæsthesia, paræsthesia or imaginary foreign body, neuralgia, paresis of the palate, dysphagia, hiccough, salivation, etc.

Pain in the pharynx and sensation of foreign body have been mentioned in several of the publications referred to in this article.

Woakes¹ endeavors to explain the paresis of the palate-muscles, so often

¹ Nasal Polypus, etc., Philadelphia, 1887.

associated with nasal catarrh, by vaso-motor paresis. He also suggests the same causation for what he calls paretic dysphagia. Schech¹ and Seifert² each report a case of spasmodic contraction of the palate, the faucial muscles also being involved in Seifert's case, both caused by nasal disease. Seifert's patient was cured by the treatment, Schech's was not.

Oesophagismus, another form of dysphagia, is reported by Netchaieff,³ by Joal,⁴ and by others. Joal observed nine cases cured by treatment of the nasal affection. It is also reflexly produced by enlarged tonsils, by dental caries, and by hypertrophy of the lingual tonsil.

Hiccough of violent and distressing character has been reported as due to nasal disease by Abramson⁵ and others.

Salivation has been reported as a nasal reflex neurosis by E. Fraenkel,⁶ Seifert,⁷ Bosworth,⁸ Peyer,⁹ Thrasher,¹⁰ and others. These cases are said to have been cured by the nasal treatment. The only manifestation I have seen of this affection is in a young lady who also suffers from asthma. In both affections, supposed to be dependent upon nasal disease (chronic rhinitis and adenoids), no benefit has been derived from any treatment. She has also consulted Dr. John N. Mackenzie, Dr. J. Solis Cohen, and others, and although every suggested method of treatment, local and general, has been carried out, both the salivation and the asthma continue to annoy her.

Whilst the above-recorded observations of neuroses of the pharynx and mouth supposed to emanate from intra-nasal irritation can hardly be denominated respiratory neuroses, they are introduced here because the pharynx is an important part of the air-tract and is often secondarily the starting-point of respiratory vaso-motor disturbances. Cough and other reflex phenomena are often directly traceable to a diseased condition of the pharynx and mouth as well as the larynx, but in nearly every such case it will be found that there coexists more or less analogous trouble of the nasal cavities, which in all probability preceded it. This is especially true in the hyperæsthesia accompanying simple congestive conditions of the pharynx and larynx in which there is excessive irritability, exhibited by a disposition to retch, cough, etc., from the slightest cause, by hoarseness from use of the voice, and sometimes by spasmodic contractions of the muscles of the pharynx and larynx, as mentioned above and in the following pages.

¹ Klonische Krämpfe des weichen Gaumens mit objectivem Ohr-Gerausch in Folge von nasaler Trigeminus-Neuralgie, Münchener Medicinische Wochenschrift, No. 22, 1886.

² Internationale Klinische Rundschau, No. 19, 1887.

³ Meditzinskoie Obozrenie, Nos. 9 and 10, 1888.

⁴ Congrès Laryngologique Français, 1889.

⁵ Journal of Laryngology, No. 5, 1890.

⁶ Loc. cit.

⁷ Internationale Klinische Rundschau, No. 19, 1887.

⁸ Diseases of the Nose and Throat, New York, 1889, p. 189.

⁹ Münchener Medicinische Wochenschrift, Nos. 3 and 4, 1889.

¹⁰ Cincinnati Lancet Clinic, October 25, 1890.

The vascular alterations in the mucous lining of the pharynx and larynx underlying these neurotic manifestations can be continuous with vaso-motor changes in the nasal spaces or reflexly dependent upon intra-nasal irritation.

LARYNX.

Aphonia dependent upon lesions of the nasal spaces is recorded by Brebion,¹ Heryng,² Baratoux,³ Max Schaeffer,⁴ A. Predborski,⁵ and others, and has been cured by the treatment of the nasal trouble. Hysterical aphonia is a well-known and troublesome affection to laryngologists, and its cure by psychical influences when local treatment of the larynx has failed has been often observed. Whether the cauterization of the nasal tissues effected a cure in this way by the revulsive action cannot be determined, as the reports of such cases are rare, and the clinical data unsatisfactory.

Laryngismus Stridulus.—The connection of glottic spasm and spasmodic croup with nasal and naso-pharyngeal diseases has been mentioned by Hack,⁶ Elsberg,⁷ and others. The amount of clinical testimony to the dependency of glottic spasm and spasmodic croup upon pathological alterations of the nose and naso-pharynx leaves no doubt about the relationship, and its importance cannot be overestimated. Coupard states that in fifty-six cases of adenoids forty-five had croup.

Lennox Browne seems inclined to think that adenoids are almost invariably present in spasmodic croup, and that their removal will result in a cure.

I have found adenoids or other obstructive lesions of the nose in almost every case of laryngeal spasm I have seen. Enlarged tonsils will also produce the same effect.

That neither adenoids nor any other obstructive lesions are necessarily present, but that it can be of a purely reflex character from intra-nasal irritation, a recent case in my experience proves. A boy six years of age who had been subject to croup was brought to me for treatment of enlarged tonsils and adenoids. The tonsils were shrunk by galvano-cautery applications, and the adenoids were removed by the forceps. I had made a careful examination at his final visit, and after removing a small remnant of adenoid tissue I dismissed him from treatment. The use of the forceps caused some discomfort and irritation, followed by headache during the afternoon. The same night he had one of the most terrifying attacks of

¹ *Revue Mensuelle de Laryngologie*, etc., December, 1885.

² *Annales des Maladies de l'Oreille*, etc., March, 1886.

³ *Ibid.*

⁴ *Monatsschrift für Ohrenheilkunde*, No. 11, 1886.

⁵ *Gazeta Lekarska*, No. 20, 1886; *Internationales Centralblatt für Laryngologie*, etc., vol. iii p. 394.

⁶ *Loc. cit.*

⁷ *Reflex and other Phenomena due to Nasal Disease*, *Archives of Laryngology*, 1883.

croup in his experience, which I relieved, when I reached the house, by an application of a cocaine solution to the naso-pharynx. Since then he has had no recurrence of croup.

ASTHMA.

Bronchial Tubes.—That asthma was associated with intra-nasal disease was known long before Voltolini¹ called attention to its connection with nasal polypi, but he was the first to cure his patient by the intra-nasal treatment. John N. Mackenzie² has shown the early recognition of this relationship. Trousseau³ speaks of its frequently commencing with symptoms of coryza, sneezing, discharge from the nose, etc. Ducros (quoted by Trousseau) thought asthma emanated from the pharynx, which he considered the starting-point of all nervous manifestations, and he treated it by applications of liquid ammonia to the throat. Biermer⁴ considers the nasal fossæ a frequent centre of irritation in reflex asthma.

Following Voltolini's paper appeared communications from Haenisch,⁵ M. Schaeffer,⁶ B. Fraenkel,⁷ and a host of later writers, and the mass of clinical evidence adduced by them in support of the theory of the production of asthma by nasal disease, and the large percentage of cures reported as resulting from the nasal treatment, should leave no doubt of its reflex dependency upon the nose in many cases.

To enter into a consideration of the various theories advanced in regard to the causation of asthma would consume more space than the limits of this paper permit.

Bergson⁸ was the first to regard asthma as a distinct disease. Before his day it was considered merely a symptom, the latter view being still retained by Rostan,⁹ Beau,¹⁰ and other later writers. Beau considered it a symptom of chronic catarrh of the small bronchi. Salter's exhaustive work¹¹ in 1860, in which he regards asthma as a nervous disease, the dyspnoea being due to reflex spasm of the bronchial tubes, and the essential pathological lesion residing in the nerve-centres, embodies the view adopted by the majority of more recent writers.

Laennec¹² had previously considered asthma a neurosis from functional

¹ Ueber die Anwendung der Galvano-Kaustik, Wien, 1871.

² Loc. cit.

³ Loc. cit., vol ii. p. 441.

⁴ Ueber Bronchiale Asthma, Volkmann's Klinische Vorträge, 1870.

⁵ Loc. cit.

⁶ Deutsche Medicinische Wochenschrift, 1879.

⁷ Verhandlungen d. Berliner Medicinische Gesellschaft, 1882.

⁸ Recherches sur l'Asthme, 1852.

⁹ De l'Asthme, Gazette des Hôpitaux, No. 31, 1856.

¹⁰ Traité clinique et expérimentale d'Auscultation appliquée à l'Étude des Maladies du Cœur et du Poumon, Paris, 1856.

¹¹ On Asthma, its Pathology and Treatment, London, 1860.

¹² Traité d'Auscultation, 2e éd., tome i. p. 78.

or organic alterations in the nerve-centres producing bronchial spasm, and Andral¹ supported this view.

Duclos² considered it a neurosis dependent upon the herpetic diathesis, and the dyspnœa due to obstruction from eczematous eruption in the bronchial mucous membrane.

Sée³ thought asthma a neurosis of the vagus from irritability of the respiratory centres manifested by cramp of all the respiratory muscles.

Trousseau⁴ regards it as a neurosis of the respiratory apparatus with bronchial spasm, but argues that the spasm is not dependent upon any inflammatory action, as persons subject to asthma have been known to have capillary bronchitis or broncho-pneumonia without a sign of asthma showing during the attacks. He deemed the essential lesion to be some alteration in the cerebro-spinal axis or respiratory centres.

In 1872 Weber⁵ first considered the possible influence of the sympathetic. He regarded asthma as a vaso-motor disturbance, the vaso-motor alterations being followed by such dilatation of the blood-vessels as to prevent the passage of air through the bronchial tubes, and thus bring about dyspnœa. That hyperæmia and swelling of the mucous membrane took place was confirmed by Stoerk. This theory has been accepted by a number of later writers, some of whom reject entirely the spasmodic element in the production of asthma.

Fraenkel attributes it to the propagation of a catarrhal congestion which causes swelling of the mucous membrane of the bronchial tubes and diminishes their calibre, somewhat similar to the vaso-motor tumefaction above mentioned.

Sir Andrew Clark⁶ adopts the theory of local vascular disturbance in the bronchi, and thinks the paroxysm due to sudden swelling of the mucous lining of the bronchial mucous membrane, like the turgescence of the nasal mucosa in hay-fever, some peripheral irritation starting the train of symptoms through diseased nerve-centres. Schlemmer⁷ argues that there are no physiological or clinical objections to the admission of both vaso-motor paresis and bronchial spasm.

Schmidtborn⁸ regards asthma as the result of spasm of the pulmonary arteries, by which the "suction-power" of the lung is diminished and less blood flows into the aorta, and he refers to the emptiness of the surface-vessels and the pale cyanotic appearance in support of this view.

The increased action of the respiratory muscles is explained by the lack

¹ Clinique Médicale, Paris, 1829.

² Bulletin Général de Thérapeutique, April, 1861.

³ Dictionnaire de Médecine et de Chirurgie, 1865.

⁴ Loc. cit., 1869.

⁵ Tageblatt der 45ten Naturforscher-Versammlung zu Leipzig, p. 169, 1872.

⁶ American Journal of the Medical Sciences, January, 1886.

⁷ L'Union Médicale, February, 1887.

⁸ Ueber Asthma Nervosum, Volkmann's Klinische Vorträge, p. 328, 1890.

of oxygen, and the overloading of the blood with carbonic acid from this insufficient blood-supply to the larger vessels and consequent loss of nerve-control over the muscles.

Block¹ discusses Schmidtborn's theory, and, whilst he considers that it has some grounds to recommend it, he rejects it because it is not altogether satisfactory. Schmiegelow,² agreeing with Sée, regards asthma as a bulbar neurosis, by which is meant a reflex hyperexcitability of the respiratory centre, which can accompany the neurotic disposition, or can result from anything that tends to weaken the system or lower the vitality; and the paroxysm of dyspnoea can be originated in any irritation transmitted to the medulla oblongata by any sensory nerve. Bosworth³ adopts the vaso-motor theory of Weber and Stoerk, as Roe and others have done, and rejects completely the idea of reflex spasm of the bronchial muscles.

According to Bosworth, the pathological change which occurs in a paroxysm is a dilatation of the blood-vessels of the bronchial mucous membrane from vaso-motor paresis, which differs from inflammation inasmuch as it is the first stage of inflammation only, and has no tendency to proceed further. Muscular spasm plays no part in the production of an attack, as the dyspnoea both expiratory and inspiratory is explained by the narrowing of the bronchial tubes from vaso-motor paresis. This is followed later by exudation, decrease of the tumefaction, and cessation of the paroxysm.

Etiology.—Whether vaso-motor paresis, muscular cramp, or both combined, are the essential pathological conditions of the bronchial tubes in asthma, the question for us to consider is, what pathological alterations in the nose can reflexly bring about an asthmatic paroxysm, and how is the irritation transmitted from the nose to the bronchial tubes?

The anatomical relations of the nasal spaces and lower respiratory tract, the absolute dependence of the latter upon the former, and the close connection between the nerve-supply of these two areas, make it easy to understand how a pathological alteration in the nasal spaces might bring about more or less disturbance along and in the lower respiratory region.

If asthma is due to disorder of the nerve-centres, as all authors more or less regard it, if it can develop in consequence of irritation of distant parts of the organism,—the skin or sexual organs, for example, according to some authors,—if it can come from simple psychic causes, as is admitted by others, how much more probable that irritation of the nasal spaces from vascular or other pathological alterations could produce a similar result!

The exposure of the nose, which is the gate-way of the respiratory tract, to external influences of all kinds, makes it the most likely focus of irritation in the production of respiratory neuroses.

Although experiment has repeatedly failed to produce asthma by arti-

¹ Volkmann's *Klinische Vorträge*, No. 344, 1890.

² Stagerup's *Forlag*, 94, S. 1889, Copenhagen.

³ *Diseases of the Throat*, 1889.

ficial irritation of the normal nasal tissues, probably because the want of predisposition in the central nervous system was lacking, the clinical experience of an army of competent observers over the whole civilized world has proved beyond doubt that asthma has at times its origin in pathological changes in the nose, if the cure of the affection by treatment of the nose is any demonstration of this fact.

The suppression of the peripheral irritation in the nose by cauterization or otherwise can put an end to the paroxysm, but does not do away with the accompanying alteration of the central nervous system, which is the main factor in the production of the reflex phenomena. Without this central functional disturbance, there could be no manifestation of a respiratory or other neurosis, and unless the normal resistance to the transmitted irritation is restored any return of the latter would bring about another paroxysm.

Is the transmission of this peripheral impression by way of the sensory nerve-filaments along the branches of the trigeminus to the basal ganglia, and is the impression there transformed and reflected to the nerve of the part affected? or is it by means of the sympathetic connections of the fifth pair that the external impression is conveyed to the point of reflex manifestation? Is the dyspnoea due to direct reflex irritability of the pneumogastric causing cramp of the respiratory muscles, or is it due to reflex disturbances of the circulation in the part affected,—vaso-motor changes,—or to both?

When considering these questions, we must recollect that in dealing with nervous manifestations of all kinds we have nothing positive except the clinical observations; the physiological and pathological laws governing them being more or less uncertain because of our limited knowledge of the nervous system. I quite agree with Schlemmer¹ that there are no known physiological laws that conflict with admitting both vaso-motor paresis and spasm of the bronchial muscles, but I do not propose to argue whether the transmission of the sensory impression to the nerve-centres is by the trigeminus or its sympathetic connections. I think that if the cerebral centres are functionally altered in any way their resistance is lowered, and their controlling power over nerve-force can be easily perverted by impressions brought to them through any of the nervous channels.

As the medulla oblongata controls both respiration and vaso-motion, the sensory impression transmitted to it from the nose or elsewhere may be projected outward as a perversion of nerve-action in the pneumogastric or in the vaso-motor system.

If a neurotic condition of the medullary ganglia exists, it is probable that a similar physiological alteration is coincident in the dependent sympathetic ganglia. It does not follow that all these ganglia are uniformly affected. Some may be more so than others, and the perverted nerve-action or vaso-motor disturbance projected outward will be manifested in the areas

¹ Loc cit.

dominated by the ganglia most affected or offering least resistance to the reflected impressions. Vaso-motor disturbances in the nose, whether from intra-nasal irritation, or brought about by the influence of distant organs, may, as Bosworth says, cause the same condition in the respiratory tract. But to do so there must be predisposition of both the medullary and the sympathetic ganglia to receive and transmit the reflected impression, and it will be most manifested where the perversion of functional activity is greatest.

That vaso motor paresis attends the asthmatic paroxysm is almost universally admitted, and Bosworth considers it, with its resulting changes, the sole pathological condition, and believes that the dyspnoea is due to it alone, the secondary hyperæmia and *dilatation* of the blood-vessels causing the obstruction. But this does not necessarily exclude spasm of the bronchial muscles, because the muscular cramp might be the result of the vessel-disturbances.

In this light I regard vaso-motor alterations as the least unsatisfactory way of explaining all reflex phenomena, because they are all manifestations of perverted function, probably due to temporary interference with nutrition from reflex vessel-disturbances.

The cramp of the bronchial muscles may result from the vaso-motor palsy, if certain physiological phenomena of muscular action have any application here. If the pneumogastric is cut, rejection of food takes place because the œsophagus *contracts* when deprived of its nervous influence. Dr. Burdon Sanderson says the muscular fibres of the bronchial tubes are in the same condition as the œsophagus and stomach after section of the vagi,—i.e., contracted or in a state of spasm.

Brown-Séquard says that after section of the cervical sympathetic the *blood-vessels* are paralyzed and the *blood-vessels* are dilated: he does not say that the *arteries* are dilated, and does not state whether the result in hyperæmia is arterial or venous. Other phenomena are *contraction* of the eye-muscles, of the muscles of the angle of the mouth, and of the erectile muscles of the ear. It is always contraction that is spoken of from this deprivation of nerve-control, and not relaxation. Corresponding results have been had from section of other nerves. Now, unless this equally applies to the muscular tissue of the arteries when their nerve-control is diminished by vaso-motor paresis, we should have contraction of one set and relaxation of another set of muscles from the same causation,—which seems to be a physiological contradiction.¹

If the arterial muscles contract, the arteries are emptied or partially so, and the hyperæmia is venous. If vaso-motor paresis resulted in primary dilatation of the arteries, we should have the same condition as in inflammatory action, and it would hardly stop short of other symptoms of inflammation.

¹ See T. W. Poole, Transactions of the Ninth International Medical Congress, vol. iii.

But, as Charcot¹ says, "this hyperæmia, however intense or prolonged it may be, never has the effect, save under exceptional circumstances, of determining by itself the development of inflammatory action."

Physiological experiment has shown that if the heart is opened immediately after the medulla and spinal cord are destroyed, it beats with regularity, *but is empty*, and all the intestinal veins are full; the blood being emptied from the arterial system into the veins. The same thing occurs in death. Now, is it irrational to apply these facts to the explanation of vaso-motor paresis, and suppose that the immediate effect of this interference with their nerve-control is contraction or constriction of the arteries of the area involved, with consequent overloading of the veins and venous hyperæmia? Such constriction is usually explained by the action of the vaso-motor constrictor nerve-fibres, whilst dilatation when present calls for an antagonistic set of nerve-fibres, the vaso-dilator nerves. Will not the loss of control over the nerves regulating the action of the arterial coats explain both phenomena? Why cannot the dilatation be secondary to continued venous hyperæmia and stasis, from the blood's being pumped through vessels which have temporarily become like veins with their contractile energy suspended? Instead of paralysis from over-distention, over-distention from paralysis ensues.

Why must we, as Foster² says, "*imagine* a muscular fibre as subject to the action of two opposing forces, the one elongating, relaxing, or dilating, the other shortening, contracting, constricting, etc.,"² if there is a way to get rid of this antagonism?

The supposition that the inherent contractile energy of the arterial muscular coat is regulated by the nerve-impulses transmitted to the vaso-motor centres (the brain and spinal cord), and that any interference with this governing function will at once release this contractile force, causing constriction at first, followed later by dilatation, is not irrational. This of course supposes that dilatation follows constriction and excludes primary dilatation. Foster, however, again says, "we have as much right to *suppose* relaxation to be the necessary antecedent of contraction as to suppose contraction to be the necessary antecedent of relaxation." There is no doubt about the right to "*imagine*" or "*suppose*," but these quotations from an established text-book on physiology show how uncertain are many of its generally-accepted teachings, and also that speculation in regard to physiological questions is legitimate. Whether the vaso-dilator nerve fibres are demonstrable or not, physiologists teach that irritation of the cervical sympathetic causes *contraction* of muscles and *constriction* of arteries, and that no vaso-dilator impulses follow such irritation. It is also taught that vaso-motor changes in the condition of the minute arteries—changes, *i.e.*, of any particular vascular area—have very decided effects on the circulation, and these effects may be both local and general.

¹ Lectures on the Nervous System, pp. 90, 91.

² Physiology, Philadelphia, 1891.

If the normal action of any organ or part of the organism is dependent to some extent upon the integrity of its circulation, and if vaso-motor impulses result in vascular disturbances of any area or organ, the function of the part must be thereby altered or interfered with.

The impairment of nerve-control over the arteries in vaso-motor paresis, involving the vasa nervorum, produces changes in the arterial supply of the nerves with distention of their veins, and consequent interference with the sensory- or motor-nerve function of the part affected.

In asthma, the vaso-motor alterations, unless limited to the mucous lining of the bronchi, can impair the innervation and circulation of the muscular tissue supplied by the branches of the vagi (of which the vasa nervorum come from the external carotid, and the vaso-motor supply from the superior cervical ganglion), with accompanying perverted muscular action.

Sommerbrodt has shown that we can have vaso-motor changes in the bronchial mucosa without asthma,—i.e., dyspnoea from obstruction without the typical asthmatic symptoms. Moreover, vaso-motor paresis limited to the bronchial mucous membrane would not account for the spasmodic contractions of the intercostal and other muscles giving rise to the peculiar jerks so often seen in asthmatic cases.

That the ganglia of the spinal nerves are frequently involved through their sympathetic connection is shown by the points (*pointes apophysaires*) tender to pressure in the lower cervical and upper dorsal regions of the spine so often seen in nervous asthma.

Therefore from this point of view there is no need for Dr. Bosworth and others to bar spasm in the production of the paroxysm, as both the vascular disturbances in the bronchial mucous membrane and the spasm of the bronchial muscles might depend upon the same sympathetic influences. That there is spasmodic contraction of the bronchial muscles during the paroxysm, most authorities admit, and that it can be brought about by irritation of the vagus is proved by the experiments of Lazarus¹ and others. But the explanation of this phenomenon has been very various, and sometimes seemingly absurd.

To attribute it, as Traube, Schech, and others have done, to *extraordinary activity of the respiratory centres* from the stimulation due to excess of carbonic acid in the blood, seems an untenable proposition. In other words, deficient oxygenation or deprivation of the normal nutrition *increases functional activity of the respiratory centres*. Does any one suppose that bad blood and poor hygienic surroundings could give increased physical strength and intellectual activity? No one doubts that such a causation might induce muscular spasm in the bronchi or elsewhere, but it could only be on the hypothesis of impaired vitality of the nerve-centres, the ganglia of which are involved in the same functional alteration, with perversion of muscular action.

¹ Experimentelle Untersuchungen zur Lehre von Asthma Bronchiale, Deutsche Medicinische Wochenschrift, 27, 1891.

Whilst impaired nerve-vitality can result from vaso-motor paresis, perversion of the nerve-tissues, or a *neurotic condition*, is the essential factor underlying the manifestation of any reflex neurosis, and the ready development of vaso-motor disturbances from nasal or other peripheral irritation is a symptom of this tendency.

Such irritability of the nerve-centres and reflex sub-centres can come from acquired or inherited causes that would bring about susceptibility to perverted function.

Gout and rheumatism or the uric acid diathesis is in a large number of cases the basis of the nervous irritability. The connection between asthma and gout or rheumatism has been spoken of by different authors.

Trousseau¹ has observed cessation of attacks of asthma coincident with the advent of rheumatism, and no return of it until the symptoms of the latter had subsided. He made the same observation in regard to urticaria, which is one of the manifestations of the uric acid diathesis.

John N. Mackenzie² also dwells on this connection, and he makes reference to Hoffmann (1760) and others as having mentioned it in the last century. It may have its basis in chronic affections or abuse of the sexual organs, causing general impairment of the nervous system.

Syphilis, inherited or acquired, may lower the vitality of the nerve-centres. Any cause whatever that can vitiate the tone of the nervous system will predispose any individual to a ready response to irritation, and easy manifestation of reflex phenomena.

What the nature of the change in the nerve-centres and reflex sub-centres may be is unknown, and the term "neurasthenia," so frequently applied to the most marked cases of nervous derangement without discoverable organic lesion, is used to cover this lack of knowledge, and has no definite meaning.

It is like many other terms used in medicine for the same purpose, such as "amaurosis," "idiosyncrasy," etc., and is simply a confession of our ignorance. That there must be of necessity a pathological condition of the nerve-centres controlling sensation, motion, and vaso-motion to permit perverted functional manifestations from peripheral causes, is as obvious as that there must be inherent alterations of the psychical centres in perversion of the mental functions.

This may be curable or incurable, and even when absolutely incurable may be so modified that with the removal of the peripheral irritation the reflex manifestation of functional perversion will cease.

That nervous asthma can come from nasal irritation has been denied by some writers who regard the cures from intra-nasal treatment as merely the effects of revulsives which would have acted equally well if applied elsewhere.

Whilst the mass of clinical evidence to the contrary is too great to

¹ Loc. cit.

² Reference Hand-Book of the Medical Sciences, 1887, vol. v. p. 238.

warrant such an assumption, it does not justify the conclusions of those who look to the nose for the source of all asthmatic attacks. The exaggeration of the importance of nasal disease as the principal, if not the sole, factor in the etiology of asthma and other nasal reflexes, into which the enthusiasm of some authors has led them, is calculated to discredit a valuable clinical observation. It is not the sole, and I doubt if we can prove it to be the most frequent, cause. Admitting the alteration of the nerve-centres with predisposition to nervous disturbance in the bronchial region, we can easily see that other forms of peripheral irritation besides nasal could bring about the asthmatic paroxysm. Cardiac trouble, renal disease, malarial influences, gastric and intestinal disturbances, irritation of the cervical sympathetic by enlarged glands and growths, and chronic bronchitis, are important considerations in the etiology of the disease. Its connection with the skin, with sexual irritation, and with rheumatism and gout, already referred to, is to be kept in mind. Psychical causes can bring about an attack without the intervention of the nose, by direct vaso-motor influences through altered nerve-centres. We can have asthma without any sign of intra-nasal lesion or intra-nasal irritability, and we can have intra-nasal pathological conditions of all kinds without any development of asthma. *Again, we can have asthma and decided lesions of the nasal spaces in the same individual, and there may be no etiological connection between them.* But, whilst this is true, the nose should always be investigated as a possible factor in the causation, and any abnormality should be treated, whether the connection can be proved or not.

Pathology.—Nasal obstruction of any kind can bring about dyspnoea, especially in sleep, but it usually lacks the essential attributes of the true asthmatic paroxysm. It is often seen in children with rhinitis, adenoids, and other nasal obstruction. The pathological conditions in the nasal mucous membrane that may induce an asthmatic paroxysm may be either inflammatory or non-inflammatory in character. Chronic rhinitis is essentially an inflammatory process, and the resulting hypertrophy of the turbinated tissues a hyperplasia due to the inflammatory action. But the resulting vaso-motor disturbances are not due to the latter, for vaso-motor paresis differs materially from the first stage of inflammation, although Bosworth argues that they are identical, but to the local irritation set up by the resulting hyperplastic tissue.

This local irritation, which is of itself a mild form of nerve-paresis, results not only from inflammatory changes in the nose, but from turgescence of the erectile tissues caused by transmitted vaso-motor alterations from distant points of the economy,—*e.g.*, the eye, stomach, liver, intestines, sexual organs, skin, etc.,—or from a diseased ganglion itself, or from any pathological lesion in the intra-nasal spaces, such as deflections, outgrowths, and spurs of the septum, from polypi and other morbid growths, from adenoid tissue in the naso-pharynx, and from atrophic rhinitis with accumulation of crusts and secretions.

Any of these conditions can irritate the terminal filaments of the trigeminus, the olfactory, and the sympathetic distributed in the nasal mucous membrane and cause reflex vaso-motor changes in the nose and in other areas controlled by their nervous and ganglionic connections, and more especially in the respiratory tract, because of its more intimate connection with the nasal spaces. This irritation transmitted to depraved vaso-motor centres will be manifested by vaso-motor alterations in the area controlled by the ganglion which has become more impaired. In the respiratory neuroses the transmission will be by way of Meckel's ganglion and the superior cervical ganglion, the latter of which controls the vaso-motion of the vagi.

Whether a sensory impression transmitted to a reflex centre is primarily transformed into a vaso-motor impulse by the local reflex centre, or whether this is done secondarily by the medulla oblongata, in which resides the central control of all respiratory and vaso-motor impulses, is a matter for speculation, because, as said before, of our vague and uncertain knowledge of the sympathetic system.

Symptomatology.—The symptoms of nasal asthma do not materially differ from those of any other form of nervous asthma, and, as these are familiar to all physicians and are found in all text-books on medicine, I shall not recount them here. But the terrible picture presented by the victim of a violent paroxysm, once seen, is never forgotten, and creates alarm even among those most familiar with it.

Diagnosis.—Whether an attack of asthma is of nasal origin can be determined in some cases by the cocaine test,—viz., the arrest or the amelioration of the paroxysm by anæsthetizing the mucous membrane of the nasal spaces with cocaine, which I have seen at times to be very efficacious. When this test fails, the exclusion of cardiac, renal, and gastrointestinal disorders would still indicate the probability of a nasal causation. The thorough inspection of the nasal spaces by anterior and posterior rhinoscopy, and the discovery of polyps, enlarged turbinates, adenoids, or abnormalities of the septum, would greatly strengthen this probability.

Even without marked pathological changes in the nose the causation might be in a decided hyperæsthesia of the intra-nasal tissues, readily manifested by the production of sneezing, cough, etc., when irritated by a probe. It is in such cases that psychical causes exert most decided influences. It is useless to consider the differential diagnosis of a typical asthmatic paroxysm and the dyspnœa of cardiac disease, pulmonary œdema, glottic spasm, laryngeal or tracheal obstructions, or hydrothorax, as no physician would be likely to confound them.

The difference, however, between nervous asthma and the asthmatic attacks in chronic bronchitis should be taken into consideration: in the former no rales precede the attack or follow its complete subsidence; whilst in chronic bronchitis, auscultation of the chest will discover moist rales both before and after the paroxysm of dyspnœa, which occurs usually

at night and is probably due to obstruction of the bronchial tubes by secretion. Such attacks are frequently the result of taking cold and grafting an acute attack of bronchitis on the already chronic disease of the bronchial mucous membrane. In nervous asthma the paroxysm, whilst most common at night, quite often appears just as suddenly during the day, and the accompanying auscultatory signs are dry, sibilant, sonorous rales, a whistling and blowing like the sounds from a distant gale of wind, which appear as suddenly as the attack, are present all through it, change into moist rales when exudation into the tubes takes place, and as soon as they are clear again there is a complete disappearance of all auscultatory signs. This is not the case in chronic bronchitis.

Prognosis.—The probability of curing a case of asthma originating in nasal irritation will depend very much upon the general condition of the patient and the length of time the attacks have been manifested. I doubt if asthma ever kills any one, but the existence of a chronic asthmatic is so miserable that this assurance is no consolation, as without the hope of cure life is hardly worth living. The prognosis is the more favorable the shorter time the disease has existed and the less the nerve-centres are impaired, and grows more and more unfavorable according to the duration of the causation and the frequency of the attacks.

Whether cases of any long duration are ever radically cured by the local treatment is questionable, notwithstanding the seemingly favorable reports of Bosworth and others. If these cases are all followed out, most of them will be found to have in time lost the temporary improvement, and relapsed more or less, requiring constant changes of climate, etc., to avoid recurrence of attacks. This is especially true of those who fail to keep up constitutional treatment for a long time.

Treatment.—Treatment should be directed first to removing the peripheral irritation, secondly to improving the condition of the nerve-centres, and thirdly to controlling the paroxysm during an attack. As the first two points will be considered under treatment of nasal reflexes in general, I will here confine myself to the management of the paroxysm. This should be both local and constitutional. The local treatment is by applications to the nasal spaces to diminish temporarily their irritability, and by inhalations moist or dry to improve the condition of the bronchial mucous membrane.

The constitutional treatment is by stimulants, alteratives, anæsthetics, and narcotics. Whether the irritability of the nasal mucous membrane is due to a simple hyperæsthesia, or to a turgescence of the corpora cavernosa, or to the presence of morbid growths or other pathological formations, the best remedy for allaying this irritability is cocaine, which acts as a stimulant to the nervi vasorum, restoring the control over vaso-motion and doing away with the venous hyperæmia. It can be best applied by an atomizer, a few drops of a four-per-cent. solution being sprayed into each nostril every five or ten minutes until the parts are thoroughly anæsthetized. Unless some decided diminution in the violence of the paroxysm

follows this application, it should not be continued, as it would be productive of more harm than good, its prolonged use being sometimes followed by a relaxation of the intra-nasal tissues. When the tissues are contracted under the cocaine application, I am in the habit of spraying the nose with a mixture composed of

Menthol,
Gum camphor, ãã gr. xxx;
Liquid cosmoline, ʒi,

which assists the action of cocaine and prolongs its effects. Of inhalations, possibly stramonium (the leaves being ordinarily used) is the best, and if mixed with saltpetre we get the combined effects of each. The mixture can be burned in a plate and the fumes inhaled.

This combination of the two remedies is the basis of most of the so-called asthma cures sold in the drug-stores, and used quite extensively with more or less relief. Other ingredients in these preparations are belladonna, hyoseyamus, lobelia inflata, pulverized aniseed, ordinary tea, etc., any or all of which may be tried, as cases differ in their susceptibility to the influence of different drugs, and all seem after a while to lose their effect, requiring a change in the remedy.

Inhalations of pyridine sometimes prove very valuable in controlling the dyspnœa, and it is more efficient when combined with ethyl iodide (or hydriodic ether). A drachm of pyridine and a half-drachm of hydriodic ether can be placed in a saucer, under a croup-tent, or some substitute, and the patient allowed to inhale the volatile fumes for half an hour.

In violent paroxysms, chloroform inhalation may be resorted to. Internal remedies should be directed to subduing the perverted action of the cerebral centres on the one hand, and improving vaso-motor control on the other. The former is accomplished by the use of remedies known as cerebral sedatives, such as opium, chloral, paraldehyde, and bromides, which not only act as sedatives to the nerve-centres, but by deoxidizing the blood retard the chemical process in the muscles which generates contractile energy, and thus reduce tendency to spasm. The latter can be done in two ways, by administration of so-called excito-motors, such as belladonna and hyoseyamus, which act by stimulating the sympathetic ganglia and thereby restore nerve-control over vaso-motion, and by motor-depressants, such as quebracho, grindelia robusta, pilocarpine, etc., which reduce the contractile energy of muscular tissue, by lessening the functional activity of the motor nerves. Opium or its active principle morphine is the most reliable of the cerebral sedatives, but in many cases it cannot be used at all, because of the peculiar susceptibility of some persons to its influence.

Chloral and bromide of potassium, in combination, are often more satisfactory. All these drugs prove most efficacious in small doses frequently repeated. Paraldehyde in my hands has been of great service. I have seen a most violent paroxysm promptly relieved by the administration of

one drachm in a single dose. Occasionally I have had to give a second dose of the same amount, but less than a drachm will usually fail to produce a satisfactory effect. I use it only at night to enable the patient to lie down and sleep. Sulphate of atropine is sometimes valuable during the paroxysm. Quebracho and grindelia robusta control to a great extent the dyspnœa of asthma, and are useful in all forms of dyspnœa.

The trouble about all these agents is that, although very satisfactory in most cases for a while, they seem after a time to lose their effect, so that we have to ring the changes in their administration, using one when another fails. Iodide of potassium is one of the most reliable remedies in treating asthma in the intervals between the attacks, and is sometimes a valuable adjunct continued during the paroxysm.

The application of ice to the spine over the upper part of the dorsal division often proves serviceable, especially when there is tenderness to pressure about the seventh cervical and upper dorsal vertebræ. I have seen also violent thumping of this region with the hand or fist give great relief, especially in cases with convulsive movements of the intercostal and thoracic muscles. Electricity in the form of the continuous current has sometimes a happy effect. When the paroxysm subsides spontaneously, or is relieved by the measures above suggested, the removal of the source of irritation in the nose may be attempted, and the constitutional treatment instituted to prevent a recurrence.

One of the most important means of preventing a recurrence of the paroxysm, and frequently of aborting it during its height, is a change of location or climate. What altitude suits an asthmatic best, whether high altitudes or the sea-level, is a question difficult to answer.

Much has been written on the "climatic treatment of asthma" (see Transactions of the American Climatological Association), but without solving the problem. Sometimes the slightest change of location will accomplish the result. I have seen cases moved only a mile or two outside the city during the paroxysm, and it ceased. I have among my patients some who never have an attack at any of the Atlantic sea-shore resorts, and others who have an attack whenever they visit such places, and must at once go to the mountains, where they enjoy perfect immunity from the trouble. I know one who has a paroxysm of asthma every time she changes her location, and prepares for the attack as a matter of course. These facts show that each individual is a law unto him- or herself, and each case requires different management. They show also that both the etiology and the treatment of asthma are open fields for future investigation.

REFLEXES OUTSIDE THE RESPIRATORY TRACT.

The intimate relations between the ear and the nose by direct communication and the dependency of ear-diseases upon nasal troubles are not points for consideration in this paper; but there are at times reflex phenomena developed in the ear without any discoverable symptoms of local disease

that have been referred to intra-nasal irritation. I have seen earache and tinnitus aurium, without any inflammation or alteration in hearing, from asymmetry of the nasal chambers. Dr. C. H. Burnett¹ has reported an interesting case of peculiar noises and audible contractions of the tensor tympani from nasal troubles. Schech,² Seifert, and others have recorded similar observations. John N. Mackenzie³ has described a peculiar condition coming on periodically, similar to hay-fever, in which there was intolerable itching, swelling, and secretion of the external meatus. These reflex phenomena are probably due to vaso-motor alterations through the medium of the otic ganglion, as it is from the ganglion the ear receives its vaso-motor and trophic supply, and are similar to the swollen and congested condition of the auricle seen after section of the cervical sympathetic.

EYE.

The direct anatomical connection between the eye and the nose makes it easy to understand how diseases could spread from one organ to the other; and since Bresgen⁴ first called attention to the fact that catarrhal conjunctivitis was often dependent upon nasal catarrh, much has been written upon the interdependence of diseases of the two organs.

As this article, however, deals only with nasal reflex phenomena, the reader is referred to another part of this work for the consideration of the connection between the eye and the nose, outside of this reflex relationship. Hack⁵ called special attention to the reflex influence of the nose upon the eye, mentioning a case of scintillating scotoma due to the turgescence of the inferior turbinate, and explained it according to his theory of reflex production given in this article.

Lachrymation may be of reflex origin from vaso-motor changes in the nose, and is often produced artificially by irritation of the nasal tissues. Conjunctival irritability with congestion about the eyes and lids may be a reflex disturbance from intra-nasal changes, and will resist all treatment until the nasal trouble is cured.

In my address before the American Medical Association, in 1885, at New Orleans, I referred to a case of reflex conjunctivitis which rebelled against all treatment until I had cured the nasal trouble. Seiler,⁶ Gradle,⁷ N. R. Gordon,⁸ and others, also speak of this connection.

Edema of the lids due to intra-nasal changes is referred to by many authors, and in a case treated by me since I have been writing this paper

¹ Medical News, July 26, 1884.

² Münchener Medicinische Presse, No. 22, 1886.

³ American Journal of the Medical Sciences, February, 1887.

⁴ Der chronische Nasen- und Rachen-Catarrh, 1881, B. i.

⁵ Erfahrungen aus dem Gebiete der Nasenkrankheiten, Wiesbaden, 1884.

⁶ Reflex Conjunctivitis, Archives of Laryngology, vol. iii., 1883.

⁷ Periodic Conjunctivitis, American Journal of the Medical Sciences, April, 1886.

⁸ Chronic Conjunctivitis caused by Nasal Disease, American Rhinological Society, 1886.

an œdema which was quite disfiguring, and had been present some weeks, was shown to be dependent upon turgescence of the erectile tissue of the middle turbinates and septum opposite, by its complete disappearance in one hour when the swollen tissues were contracted by cocaine. Its reappearance when the effect of the cocaine subsided, and its final cure within a week by cauterization of the hypertrophic tissues, was conclusive demonstration.

Asthenopia, intolerance of light, retinal hyperæsthesia, *muscæ volitantes*, pain in eyeballs, contraction of visual fields, redness of eyelids, muscular twitching of lids, blepharospasm, phlyctenular ophthalmia, trophic changes of the cornea, etc., have been recorded by numbers of writers.

Most of the reflex troubles of the eye from nasal irritation mentioned by these writers are vascular, secretory, and trophic disturbances that could depend upon vaso-motor alterations, whether emanating from a similar alteration in the nose of local or of distant origin, or from pathological changes causing irritation of the nasal branches of the trigeminus. These pathological conditions were polyps, chronic rhinitis, hypertrophy of the turbinates, spurs and outgrowths from the septum, adenoids, rhinoliths, etc.

Blepharospasm and twitchings of the eyelids, mentioned by Bettman, Hamilton, and others,¹ are of the nature of choreic manifestations, such

¹ M. Bresgen (Zur Entwicklung von Refractions- und Stellungen-Anomalien des Auges in Folge von Nasenerkrankungen, Deutsche Medicinische Wochenschrift, 1884); Hoffmann (Zusammenhang von Nasen und Augenaffectionen, Deutsche Medicinische Wochenschrift, No. 25, 1885); Gruening (Reflex Ocular Symptoms in Nasal Affections, New York Medical Record, January 30, 1886); Masini (Dei Rapporti fra alcune Malattie del Naso con alcune Malattie degli Occhi, Bollettino di Oculistica, Nos. 1 and 10, 1885 and 1886); Beverley Robinson (Reflex Ocular Symptoms in Nasal Disease, New York Medical Record, April 3, 1886); Ziem (Intra-oculare Erkrankungen bei Nasenleiden, Berliner Klinische Wochenschrift, xxxviii., 1887); Bettman (Ocular Troubles of Nasal Origin, Journal of the American Medical Association, May, 1887); Gradle (Ocular Symptoms due to Nasal Affections, Archives of Ophthalmology, xvi., 1887); Neiden (The Connection between Diseases of the Eye and the Nose, Archives of Ophthalmology, xvi., 1887); J. A. White (Eye Troubles of Reflex and Neurotic Origin, North Carolina State Medical Society, 1887, Virginia Medical Monthly, October, 1887); Rothholtz (Ueber die Beziehungen von Augen-Erkrankungen und Nasen-Affectionen, Deutsche Medicinische Wochenschrift, lii., 1887); L. H. Taylor (Ocular Troubles as influenced by Nasal Disease, Journal of the American Medical Association, November, 1888); Lennox Browne (Reflex Association of Diseases of the Eye and Nose, British Medical Journal, May, 1887); W. Cheatham (Nasal Reflexes as a Cause of Disease of the Eye, American Practitioner and News, 1887); V. Augagneur (Pathologie et Traitement de la Kerato-Conjunctivite phlyctenulée, Revue Médicale de l'Est, October, 1888); E. Fletcher Ingals (Hypertrophic Rhinitis with Ocular Troubles, etc., American Rhinological Society, October, 1889); Maxwell (Chronic Nasal Catarrh as a Reflex Cause of Accommodative Asthenopia, Ophthalmic Review, vol. vii. p. 305); Despagne (Rapport entre les Maladies des Yeux et du Nez, Société française d'Ophthalmologie, Paris, August, 1889); T. K. Hamilton (Ocular Symptoms due to Disease of the Nasal Cavities, Transactions of the Intercolonial Medical Congress of Australasia, 1889); A. Trousseau (Troubles oculaires d'Origine nasale, Bulletin Médical, April, 1889); John Dunn (Adenoids of the Naso-Pharynx in Children, etc., Virginia Medical Monthly, September, 1891); Couetoux (De la Kerato-conjunctivite d'Origine rhino-pharyngienne, Annales d'Oculistique, December, 1891).

as convulsive tic, etc., claimed by some authors to be due to nasal irritation.

F. J. Quinlan¹ has reported a case of continued instead of interrupted muscular spasm in a patient with strabismus following fracture of the nose, cured by the operation for restoring the symmetry of the nasal chambers.

Ziem² has reported three cases of iritis following suppuration of the nose, and cured by the treatment of the latter and hypodermic injections of pilocarpine.

The connection of that obstinate and annoying eye-disease phlyctenular ophthalmia with nasal affections seems to be twofold, both by the continuity of the mucous surfaces and by reflex action in as far as the intra-nasal irritation from chronic rhinitis and adenoid tissue causes reflex vaso-motor and trophic changes in the conjunctiva and cornea. Couetoux and Dunn in their papers emphasize the importance of the association of this disease with adenoids of the naso-pharynx; and my experience is quite in accord with theirs, that an examination of the children subject to it will reveal the presence of these growths, which must be removed to insure a speedy recovery.

Such reflex phenomena as *muscæ volitantes*, cloudy vision, contraction of the visual field, as reported by Hack, Hamilton, Masini, Browne, Bettman, Ziem,³ and others, should lead us to look to the nose as a possible starting-point of the ocular disturbance known as glaucoma, inasmuch as its etiology is still involved in some obscurity, and every possible cause is worthy of consideration. Lennox Browne's case of a woman attacked by glaucoma who was rapidly cured by the removal of nasal polyps demonstrated this. Rampoldi⁴ also speaks of the connection between glaucoma and nasal disease.

Not only have these reflex manifestations in the organ of vision been cured by the treatment of the nasal affection, but similar troubles have been artificially produced by operation in the nasal spaces. Berger,⁵ Ziem,⁶ and Schmidt-Rimpler⁷ report cases of contraction of the visual field and amblyopia following galvano-cautery operations and removal of polypi.

Similar ocular troubles have been recorded again and again as reflexes in connection with diseases of the teeth, irritation of the cervical branches of the sympathetic, diseases of the digestive tract, disturbances of the sexual organs, and in hysteria, as I have elsewhere shown.⁸

These reflex manifestations are sensory, motor, and trophic in an area

¹ Case of Convergent Squint, New York Medical Record, May, 1891.

² Iritis bei Eiterung der Nase und ihrer Nebenhöhlen, Centralblatt für Praktische Augenheilkunde, December, 1887.

³ Wiener Klinische Wochenschrift, No. 12, 1889.

⁴ Clinique Ophthalmologique de la Faculté de Pavie, Milano, 1884.

⁵ Archiv für Augenheilkunde, vol. xvii. p. 293.

⁶ Centralblatt für Augenheilkunde, vol. xi. p. 181.

⁷ Klinisches Monatsblatt für Augenheilkunde, October, 1887.

⁸ Virginia Medical Monthly, October, 1887.

controlled by the trigeminus and the sympathetic, and are due to vascular disturbances in the domain of the branches of the ophthalmic ganglion caused by transmission of the peripheral irritation in the nasal spaces to this ganglion and its connections, vaso-motor paresis being the principal pathological alteration underlying the production of these phenomena.

MIGRAINE, CONGESTIVE HEADACHES, NEURALGIA (SUPRA-ORBITAL AND TIC DOULOUREUX).

The connection of the nose with head-pains of various kinds, whether attended with gastric disturbances or not, has been recorded by many writers. Migraine, or sick headache, first denominated a neurosis by Dr. George M. Beard, has been cured by intra-nasal treatment in at least sixty to seventy per cent. of over three hundred cases reported by Hack,¹ Sommerbrodt,² Goetze,³ Schaeffer,⁴ Rosenbach, and others. Rudolph Ferber⁵ in advance of any of these authors had referred to the connection between intra-nasal disease and migraine.

So-called congestive headaches have been repeatedly associated with abnormal conditions of the nasal passages and cured by the relief of the nasal troubles. Meyer called attention to the cephalalgias often accompanying adenoids.

Tornwaldt⁶ also lays stress upon the point. Ménière⁷ reports a case of headache of two years' standing cured by cauterization and removal of adenoids. Hack speaks of headache as a turbinated engorgement. Harrison Allen,⁸ Glasgow,⁹ and Roe¹⁰ treat fully of this relationship. Joal¹¹ calls attention to the irritability of the nasal erectile tissues accompanying the headaches frequently encountered in young persons of both sexes approaching manhood and womanhood, and concludes that they are caused by intra-nasal changes which occur in sympathy with the irritation of the sexual apparatus so often manifested at the advent of puberty.

Neuralgias of the branches of the trigeminus have been reported by numerous observers as dependent upon nasal and naso-pharyngeal affection, —Hartmann,¹² Hack,¹³ Schaeffer,¹⁴ Sommerbrodt,¹⁵ and others.

¹ Loc. cit.

² Loc. cit.

³ Loc. cit.

⁴ Deutsche Medicinische Wochenschrift, No. 23, 1884.

⁵ Der Niese-Krampf u. deren Beziehung zur Migraine, zum Bronchial Asthma u. zum Heufieber, Archiv d. Heilkunde, 10ter Jahrg., Leipzig, 1869, p. 586.

⁶ Loc. cit.

⁷ Revue Mensuelle de Laryngologie, July, 1888.

⁸ Medical News, March, 1886.

⁹ Transactions of the American Laryngological Society, May, 1887.

¹⁰ Medical Review, August, 1888.

¹¹ Revue Mensuelle de Laryngologie, etc., July, 1888.

¹² Loc. cit.

¹³ Loc. cit.

¹⁵ Loc. cit.

¹⁴ Loc. cit.

The pathological alterations that cause reflex neuralgias are adenoids, turbinated hypertrophy, especially of the middle and posterior parts of the inferior turbinate, spurs from the septum, and intra-nasal synechiæ. In my experience, hypertrophy of the middle turbinate is the most common cause of nasal reflex neuralgias and headaches, as of cough. Every one knows that neuralgia can result from nasal obstruction, as frontal headaches are quite common with colds in the head.

These reflex manifestations of pain, neuralgia, etc., may be explained on the hypothesis of a local irritation's bringing about limited vaso-motor changes in persons of neurotic disposition on the one hand, or on that of a long continuance of this irritation extending to, and eventually involving, healthy nerve-centres, on the other hand.

Pain is usually described as an *exaltation* of the ordinary function of sensation, a hyperæsthesia, or excess of sensory function, but it is probably more correct to speak of it as a *perturbation* of the ordinary function.

It is well known that frequently in acutely-inflamed parts the tactile perception is blunted, which would not be the case if pain or neuralgia were a hyperæsthesia (Vanlair).¹ Any cause that can interfere with the proper performance of the sensory machinery will alter the nerve-function and cause pain.

Any injury or peripheral irritation can cause local pain by interfering with the normal function of the peripheral sensory nerves at the seat of injury or irritation, but to produce reflex manifestations this irritation must be transmitted to the ganglionic connections of the part. This reflex will be vaso-motor, sensory, or motor, according to the mode and direction of this transmission.

Neuralgia or pain will be reflexly produced if the irritation is transmitted to the posterior root of any spinal nerve, provided this root is functionally altered. It does not appear rational to say that it may be in a state of "exaltation" or in a condition of "increased functional activity." It must, on the contrary, be in such a condition that it cannot properly perform its ordinary functions.

Its functional activity is *decreased*, not increased. Whether this lowered vitality is due to acquired disease or inherited diathesis that causes functional derangement of the nervous system, or to vaso-motor disturbance, makes no essential difference. In all the subjects of constant neuralgias the probable alteration of the posterior root of the nerve, in the domain of which the neuralgia develops, is a condition of atrophy more or less pronounced (Anstie).

There is at first vaso-motor paresis, followed by non-inflammatory atrophy. As the fifth pair resembles a spinal nerve in having two roots, these remarks are applicable to trigeminal neuralgias. In a case of Rom-

¹ Journal de Médecine de Bruxelles, 1865.

berg's¹ with trigeminal neuralgia there was found almost complete destruction of the Gasserian ganglion from pressure of an internal carotid aneurism which caused atrophic softening.

Reflex neuralgia may depend on three causes,—local disease or irritation of the peripheral ends of the sensory nerves, alteration of the nerve-centres, and morbid conduction of the nerve-trunks. Anatomical changes in the nerve-terminals and branches are rare, and inflammation or neuritis is exceedingly uncommon.

We can have pain from morbid action in the sensory root of the nerve without any peripheral irritation; or a peripheral irritation that would evoke no response in a perfect state of health can produce neuralgia when the nerve-centres are functionally altered. As post-mortem examination has seldom revealed any discoverable pathological alterations in the nerve-trunks or sensory nerve-centres of individuals who were victims of obstinate neuralgias, we must infer that the perversion of sensory function was due to alterations of nutrition from vaso-motor disturbances.

If peripheral irritation is reflexly transmitted as a vascular disturbance to any part affected, it results in alterations of the circulation of that area, affecting more or less the nutrition of the nerves, with consequent perversion of their normal function. If the reflex impression involves the posterior root of the nerve, the resulting alteration of the sensory function is expressed by pain. Therefore reflex neuralgias of the trigeminus from intra-nasal irritation by pathological alterations of the nasal spaces, or by secretory and irritative changes, may primarily be due to vaso-motor paresis more or less pronounced. In subjects with morbid conditions of the nerve-trunks and with already lowered vitality of the sensory nerve-centres the local vaso-motor changes, the immediate result of the lowered vitality, can readily involve a greater or lesser area controlled by the nerves subjected to abnormal irritation. But if the centres are healthy, the local vaso-motor paresis could only involve the nerve-trunks after a long continuance of the peripheral irritation, the length of time that such effect could be brought about depending on the greater or less perfection of the centres, and their corresponding resistance to implication in the pathological process. This explains why the same abnormalities in the nasal passages produce neuralgias in some individuals and not in others, and may also explain the different expressions the neuralgias assume in different individuals, the conduction of the nerve-trunks, and the healthy resistance of the ganglionic connections and nerve-centres, being as varied as muscular strength, powers of endurance, or intellectual capacity.

CHOREA.

Probably chorea (the so-called delirium of the sensori-motor ganglia) and choreiform convulsions have been the least observed of all the reflexes

¹ Disease of the Nervous System, Syd. Soc. Trans., vol. i.

supposed to be connected with nasal troubles. Cases of chorea partial or general have been reported by Elsberg,¹ B. Fraenkel,² Jacobi,³ J. L. Sallinger,⁴ Bosworth,⁵ Coriveaud,⁶ Lichtwitz,⁷ Peltsohn,⁸ and the author.⁹

Jacobi has seen a dozen cases of complete chorea cured by nasal treatment alone. The only case I have seen thus cured was a partial chorea, reported in my paper read before the North Carolina Medical Society.

Fraenkel's, Lichtwitz's, and Peltsohn's were cases of so-called "convulsive tic," a species of chorea with rapid contractions of a few muscles limited to one side of the face. I have included these under chorea, because these partial convulsions have been known to develop into general chorea. Schech's¹⁰ and Seifert's¹¹ cases of spasmodic contraction of the palatal and faucial muscles, already referred to, were a species of chorea limited to these muscles.

These choreiform convulsions have been found associated with rhinopharyngitis, deflections of the septum, tonsillar hypertrophy, adenoids, etc. Their cure by the nasal treatment is the clinical evidence of their relationship with the nose, and we have no other evidence to prove that general eclampsia can result from intestinal irritation, or that local convulsions can come from local irritation. Dr. Bosworth¹² says that no satisfactory connection has been shown between chorea and nasal disease, and he attributes the cure by nasal treatment to the building up of the general health by improving respiration and digestion on the one hand and removing a focus of peripheral irritation in a neurotic individual on the other. This applies equally to all reflex manifestations, of whatever nature. They can occur only in neurotic individuals, and must either be due to long-continued peripheral irritation or proceed from a diseased ganglion or nerve-centre whose functional perversion may be awakened by external influences that in a normal condition of the nervous system would produce no effect. We are dealing with theory merely when attempting to explain any reflex phenomena, and the only question is which theory is most rational in regard to chorea. That of vaso motor alterations, vaso-motor palsy, seems most generally applicable, on the supposition that the vascular changes bring about muscular contraction and muscular spasm, or perverted muscular action.

¹ Archives of Laryngology, vol. iv. p. 1883.

² Berliner Klinische Wochenschrift, No. 28, 1884.

³ Partial and sometimes General Chorea Minor from Naso-Pharyngeal Reflex, American Journal of the Medical Sciences, April, 1886; and Nasal-Reflex Chorea, New York Medical Record, May, 1890.

⁴ Polyclinic, Philadelphia, June, 1887.

⁵ Deformities of the Nasal Septum, New York Medical Record, January, 1887.

⁶ Journal de Médecine et de Chirurgie Pratiques, March, 1888.

⁷ Loc. cit.

⁸ Berliner Klinische Wochenschrift, No. 32, 1891.

⁹ The Nose: its Criminal Aspect, etc., North Carolina Medical Society, 1888.

¹⁰ Münchener Medicinische Wochenschrift, No. 12, 1886.

¹¹ Internationale Klinische Rundschau, No. 19, 1887.

¹² New York Medical Record, May 17, 1890.

Troubles of sensation, troubles of sight, troubles of innervation in the apparatus of organic life, palpitation of the heart (anæmic bruit), vertigo, noises in the ears, etc., which sometimes accompany chorea, are effects elsewhere seen of vaso-motor paresis.

The fact that the paralysis which is sometimes present during and which usually precedes the convulsions is always most pronounced in the part where the convulsive movements are greatest, seems to indicate that the contractions of the muscles are due to lack of nerve-control over them, which might result from impairment of nerve-nutrition caused by vaso-motor paresis.

There is not an excitation of nerve-force, an explosion of nerve-energy, as so often stated, but a depreciation of nerve-force, or a loss of the nerve-control which regulates the contractions of muscles. These contractions are similar to the unconscious movements of the drowning, which Dr. B. W. Richardson¹ says are simply the result of the action of muscles from which the controlling power of the nerve-centres has been removed.

EPILEPSY, VERTIGO, APROSEXIA, ETC.

Epilepsy.—Epilepsy due to nasal troubles has been reported by Hack,² Loewe,³ Elsberg,⁴ Schmaltz,⁵ Fincke,⁶ A. Cartaz,⁷ Sallinger,⁸ McBride,⁹ Heryng,¹⁰ Bosworth,¹¹ Dress,¹² Crossfield,¹³ Schneider,¹⁴ Abramson,¹⁵ the author,¹⁶ and others. Schneider reports six cases in his own experience, all cured by treatment of the nose, being dependent upon the irritation caused by polyps, exostoses, hyperplasia, angioma, etc. Similar cases recorded were from similar and other intra-nasal changes.

Vertigo from nasal irritation has been reported by quite a number of authors, Hack,¹⁷ four cases, Heryng,¹⁸ three cases, E. Fraenkel,¹⁹ two cases, Gennaro,²⁰ Joal,²¹ nine cases, of which Fauvel supplied three, Cadier one, and Ruault one. Schmaltz,²² Massei,²³ and others also report similar cases.

¹ Braithwaite's Retrospect, July, 1891, p. 255.

² Loc. cit.

³ Loc. cit., Allgemein. Med. Central Zeitung, No. 76, 1882.

⁴ Loc. cit.

⁵ Loc. cit.

⁶ Deutsche Medicinische Wochenschrift, No. 4, 1885.

⁷ La France Médicale, Nos. 89 and 90, 1885.

⁸ Loc. cit.

⁹ New York Medical Record, vol. xxix. p. 137.

¹⁰ Loc. cit.

¹¹ Loc. cit.

¹² American Rhinological Society, 1887.

¹³ American Medical Association, Meeting of 1889.

¹⁴ Berliner Klinische Wochenschrift, No. 37, 1889.

¹⁵ Loc. cit.

¹⁶ Loc. cit.

¹⁷ Berliner Klinische Wochenschrift.

¹⁸ Loc. cit.

¹⁹ Loc. cit.

²⁰ Archivij Ital. di Laringol., October, 1886.

²¹ Le Vertige Nasal, Revue Mensuelle de Laryngologie, etc., July, 1887.

²² Loc. cit.

²³ Patologia e Terapia della Faringe, delle Fosse Nasale, etc., Milan, 1890.

The authors attempt to explain these as a reflex phenomenon from the nose, the intra-nasal changes by way of Meekel's ganglion causing localized vaso-motor alterations and anæmia in the brain.

Whilst this may be so, it is not worth while to go out of the way for such an explanation, when in all probability these cases belong to the category of "aural vertigo," the same intra-nasal changes being capable of causing sufficient pathological conditions of the Eustachian tube, drum-cavity, etc., to bring about vertigo from alterations in the aural circulation.

Aprosexia.—Another nasal reflex dependent upon the connection between the nose and the brain, which Guye¹ has called *aprosexia*, being inability to fix the attention, loss of memory, etc., has been treated of, not only by this author,² but also by R. Hingston Fox,³ Brugelmann,⁴ Mas-succi,⁵ Rumbold,⁶ William Hill,⁷ M. Bresgen,⁸ and others.

Melancholia and other mental troubles have been also referred to as occasionally dependent upon nasal irritation causing intra-cranial circulatory disturbances by reflex vaso-motor changes. Such troubles, especially epilepsy from nasal disease, were supposed by Hack to be partially explained by a direct communication between the nasal passage and the subdural and subarachnoid spaces.

Flatau's⁹ investigations into the lymphatics of the nose, the subarachnoid space, and the meninges confirm the close relationship of the nose and brain through the lymphatic channels. The intimate connection between the intra-nasal and the intra-cranial circulation might also help to explain the ready transmission of changes in the nasal circulation to the brain with resulting vaso-motor paresis and anæmia, but the only demonstration of the relationship between the nose and these cerebral symptoms is a clinical one. There is no question about the improvement effected in the mental condition of many children by removing adenoids and relieving nasal obstruction from whatever cause, but we can only theorize in regard to the explanation of the phenomenon.

STOMACH.

That the stomach and the nose have both a direct and a reflex relationship is evident: direct, because the mucosa of the nose is continuous with that of the pharynx, cesophagus, and stomach, and nasal secretions often pass into the stomach involuntarily, and can under certain circumstances produce gastric disturbances,—even vomiting; reflex, because the innervation of

¹ Reflex Neuroses of Nasal Origin, British Medical Journal, July, 1887.

² British Medical Journal, September, 1890.

³ Lancet, May, 1888.

⁴ Therapeutische Monatshefte, ii., 1889.

⁵ Lasseгна Critica Internazionale, January, 1889.

⁶ American Rhinological Association, September, 1888.

⁷ British Medical Journal, September, 1889.

⁸ Monatsschrift für die Gesamte Sprachheilkunde, July, 1891.

⁹ Deutsche Medicinische Wochenschrift, No. 41, 1890.

the stomach is by the pneumogastric, and if nasal changes can cause reflex manifestations in one part of its distribution they might do so in another.

Gastralgia, indigestion, flatulency, vomiting, etc., have been recorded as produced by intra-nasal changes. Mackenzie (see his historical notice), Gennaro,¹ Dress, Secchi, Buck,² and others have called attention to this connection. On the other hand, a stuffy sensation about the nose has been observed by some authors as a sequela of indigestion or of overloading the stomach.

Whilst I have never met with any cases of reflex troubles of the stomach that could be traced to intra-nasal disease, I have no doubt that such pathological conditions could be an etiological factor in digestive disturbances, because of an analogous case that fell under my observation some time back. A lady who suffered from repeated headaches due to defective convergence of the eyes, amounting at times to diplopia, was also a victim of such aggravated dyspepsia that she could eat very little, and only of a very limited bill of fare. Tenotomy of both external recti was performed, with resulting perfect convergence and complete disappearance of the headaches. Curious, however, to relate, from the same date all signs of dyspepsia or indigestion disappeared, and she could eat without discomfort anything put before her.

In this case in all probability the general nervous disturbance from the strain of the eye-muscles had caused the digestive troubles, and, as pathological changes in the nose can bring about similar neurotic conditions from the peripheral irritation, it is not improbable that indigestion might thus result either from the reflex irritation of the pneumogastric or from the general neurotic disturbance.

HEART.

The manifestation of heart-disturbance from nasal irritation has been referred to incidentally by several authors, but especially by Hack,³ Küpper,⁴ Stanislaus von Stein,⁵ Thompson,⁶ and Palombieri.⁷ In Stein's cases there was a sensation of heaviness, retraction, and pain, palpitation, vertigo, difficulty of breathing, and præcordial weight, and the cure was effected by cauterization of the swollen inferior turbinated.

GRAVES'S DISEASE.

Graves's disease, or *exophthalmic goitre*, is also a circulatory disturbance that has been reported as sometimes due to the reflex influence of nasal irritation by Hack,⁸ who treated a case of exophthalmic goitre associated

¹ Archivij Ital. di Laringol., October 15, 1886.

² New York Medical Record, August 18, 1888.

³ Deutsche Medicinische Wochenschrift, No. 51, 1884.

⁴ Monatsschrift für Ohrenheilkunde, 1889.

⁵ Cincinnati Lancet Clinic, August, 1890.

⁶ Gazzetta degli Ospit., August, 1890.

⁷ Deutsche Medicinische Wochenschrift, No. 25, 1886.

⁸ Loc. cit.

with chronic rhinitis, and as the rhinitis improved the goitre diminished, the tachycardia vanished, and sight returned.

Felix Semon,¹ on the contrary, had this disease develop in one of his patients after an operation for nasal polypus who had no signs of it previously. B. Fraenkel² and Hopmann³ both report cases cured by the nasal treatment.

Hopmann's case had atrophic rhino-pharyngitis.

In Fraenkel's case electricity failed, and afterwards the nasal treatment succeeded. George Stoker⁴ presented a case to the Medical Society of London, November 25, 1888, in which he had effected a cure by cauterization of the middle turbinates after every other treatment had failed, and also related another similar case with like result.

The pathologic condition in the nose was simple hypertrophic rhinitis. Muschold⁵ reports a case similar to the above of a woman who at the menopause manifested sundry nervous troubles, headache, palpitation of the heart, and pain in the cardiac region, followed by slow development of goitre and visual disturbance in the right eye, but very little exophthalmos. Examination of the nose showed hyperplasia of the inferior turbinate.

Its removal was followed immediately by disappearance of the headache, three days later of the eye-troubles, and in seven days the nervous symptoms about the heart were gone. The goitre slowly and gradually disappeared after the nasal trouble was cured. Cozzolino also reports a case.

These circulatory neuroses which have been demonstrated clinically to be connected with intra-nasal irritation may be due to the resulting vaso-motor changes, as they are all symptoms that can arise from temporary or continued disturbances of the blood-vessels diminishing the arterial supply consequent upon vaso-motor paresis, the area involved depending on the ganglion or reflex centre most affected.

In this connection we might consider the possibility of that inexplorable affection "angina pectoris" without organic heart trouble being at times of the same causation, as it is usually denominated a vaso-motor neurosis, and has been known to have developed from pivoting a tooth,—*i.e.*, from peripheral irritation of a branch of the trigeminus.

SKIN DISEASES OF THE NOSE AND FACE.

The relation between the intra-nasal tissues and the cutaneous surface of the nose and contiguous parts of the face has been recognized since the days of Willis and Sylvius, according to John N. Mackenzie.⁶

¹ British Medical Journal, April, 1887.

² Berliner Klinische Wochenschrift, No. 6, 1888.

³ Ibid., No. 42, 1888.

⁴ British Medical Journal, December 1, 1888.

⁵ Deutsche Medicinische Wochenschrift, February 4, 1892.

⁶ Loc. cit., American Journal of the Medical Sciences.

Bresgen,¹ Elsberg,² Schmiegelow,³ G. Hunter Mackenzie,⁴ and Lavrand⁵ have reported cases of erythema and erysipelas due to chronic rhinitis. Fenykövy⁶ tries to make out a connection between urticaria and nasal disease; Arnozan⁷ reports three cases of erythema and acne accompanying intra-nasal affections and cured by the treatment of the latter. Seiler⁸ adds a contribution to the clinical connection between intra-nasal and skin affections.

Major⁹ (of Montreal) records four cases demonstrating this relationship.

In the discussion of Major's paper, Roe, Mackenzie, and Daly, whilst agreeing that erythema resulted from intra-nasal lesions, were not disposed to admit the connection of the latter affections with erysipelas. Delavan, however, agreed with the author. I have seen erysipelas of the face follow the removal of polyps and the too energetic use of the galvano-cautery, and therefore am of the opinion that it could result from intra-nasal lesions, but that it was more probably the result of direct infection through arteritis *via* the naso-lobar artery and vein, first described by François Frank,¹⁰ than of reflex action. The production of erythema, acne, etc., reflexly through vaso-motor alterations is easier to explain physiologically. The rubicund nose is a reproach and an annoyance to the unfortunate possessor, whether he is convivially inclined or not, and if it is dependent upon intra-nasal lesions causing vaso-motor changes in the cutaneous circulation it is a loophole of escape from this disfiguring affliction.

As a case in point, I will relate the following. A few months ago one of my patients, a young man of most correct habits, who rarely indulged in stimulants of any kind, called on me for relief from a distressing tinnitus aurium. His nose had unfortunately that peculiar red appearance so often supposed to be indicative of over-indulgence in drink. In looking for the cause of the noises in the ear I discovered a large spur growing from the left side of the septum and apparently united to the turbinated tissues opposite. After thoroughly anæsthetizing the nose with cocaine I used a probe to decide whether it had become adherent to the turbinate, and observed that the nose became redder from the irritation caused by the probe. Experimentally I continued the manipulation until the redness extended from the end of the nose to the bridge and up to the forehead above the frontal sinus. With the cessation of the artificial irritation the redness gradually subsided. The removal of the spur resulted in an absolute disappearance of the nasal erythema that had been present for several years. These reflexes of the skin can be explained only by vessel-disturbances resulting from the intra-nasal irritation.

¹ Loc. cit.

² Loc. cit.

³ Loc. cit.

⁴ Loc. cit.

⁵ Société Scientifique Médicale de Lille, 1891.

⁶ Wiener Medicinische Presse, 1884.

⁷ Association Scientifique Française, Toulouse, 1887.

⁸ Journal of the American Medical Association, November 5, 1887.

⁹ Transactions of the American Laryngological Association, May, 1889.

¹⁰ Thèse Inaugurale, Paris, 1875.

SEXUAL ORGANS.

The importance of the connection between the nose and the sexual organs, whilst referred to previously, was first clearly established by John N. Mackenzie¹ in an article referred to. Several other writers have since called attention to the same relationship.

Ziem,² Dress,³ Bloch,⁴ and Körner⁵ endeavor to prove a connection between adenoids and other forms of nasal obstruction and incontinence of urine, which they state was cured by treatment of the nasal trouble, but the explanation of this connection is not satisfactory.

The *sympathetic* relations between the nose and the genital organs has been demonstrated again and again in the manifestations of local nasal reflex phenomena, such as sneezing, dyspnoea, epistaxis, etc., from irritation of the sexual apparatus, whether in periods of physiological activity or from disease, by Mackenzie,⁶ Championnière,⁷ Buck,⁸ Joal,⁹ Peyer,¹⁰ and others. The special causes of reflexes of the nose and respiratory tract emanating from the genital organs are excessive abuse of their physiological function, the disturbances attending the advent of puberty, pregnancy, the menopause, chronic affections of the uterus and ovaries, and all the abnormalities of menstruation.

NEURASTHENIA AND HYSTERIA.

The relationship of so-called neurasthenia, hysteria, and allied conditions of the nervous system to nasal disease is a mooted question. The statement that the general perturbation of the nervous system represented by these terms is at times a reflex disturbance from intra-nasal disease opens up to the nose and rhinologists a territory long since pre-empted by the uterus and gynecologists. This invasion of a "staked claim" has been made by Dr. Polo,¹¹ Dr. North,¹² Dr. Daly,¹³ Dr. Potter,¹⁴ Dr. Marcel,¹⁵ of Bucharest, and others.

Dr. Polo's case of a girl with hysterical attacks was cured by cauterizing the turbinates. Marcel's case, who had convulsive movements, loss of consciousness, etc., for seven years, was cured by the removal of polypi.

¹ Loc. cit.

² Allgemeine Medicinische Zeitung, No. 64, 1885.

³ Loc. cit.

⁴ Loc. cit.

⁵ Münchener Medicinische Wochenschrift, July, 1890.

⁶ Loc. cit.

⁷ La Pratique Médicale, July, 1888.

⁸ New York Medical Record, August 18, 1888.

⁹ Revue Mensuelle de Laryngologie, etc., p. 74, 1888.

¹⁰ Ibid., December, 1889.

¹¹ Gazette Médicale de Nantes, September, 1887.

¹² American Rhinological Society, September, 1888.

¹³ Transactions of the American Laryngological Society, 1889.

¹⁴ Buffalo Medical and Surgical Journal, 1891.

¹⁵ Tenth International Congress, Berlin, 1890.

The hysterical aura, instead of starting from the ovary and mounting to the epigastrium, etc., began with a pricking in the left nostril, passing with painful sensation to the forehead and then to the neck, with a feeling of strangulation. Dr. Daly's cases suffered with insomnia, indigestion, mental irritability, etc., or symptoms of a general nervous disturbance, and were benefited by the nasal treatment.

In 1888 I reported to the North Carolina Medical Society¹ a peculiar case of hysterical manifestations, ending in a cataleptic condition, in the wife of a physician who had been the rounds to find relief for her. Anstie, Marion Sims, Hammond, and others were consulted. Each attributed her condition to a different causation. Her husband consulted me as to the possibility of intra-nasal irritation having anything to do with the symptoms.

To bar all psychical element, he told her he wanted me to see if she had any nasal catarrh, as she complained of a stuffy feeling about the nose. Curious to relate, the moment a probe was passed into the nasal passages an attack was developed, and she remained unconscious for hours. Even the irritation from a spray to the nostrils brought on an attack. The nasal treatment resulted in great amelioration of all the symptoms, and to this day, four years after, the improvement has continued.

Such cases as these only show that the possibilities of peripheral irritation in certain conditions of the nervous system, whether in the nose or elsewhere, are almost illimitable; but it is well to confine ourselves within proper limits in attempting to prove a definite connection between the nervous manifestation and the existence of pathological changes in the nasal spaces.

Dr. J. Solis Cohen sounded a note of timely warning in his article "Look beyond the Nose,"² and the rhinologist should not be led into the conclusions of a narrow specialism in considering this question. Even when the nervous phenomena are thus seemingly benefited by removing abnormalities from the nose, or by cauterizing swollen nasal tissues, we cannot with certainty say that the same result might not have come from revulsives elsewhere applied, or that the effect was not psychical.

Schreiber,³ for example, in a discussion on this subject, in 1885, reported cough cured by cauterizing the neck, and epilepsy and hysteria, without any discoverable deviation from the normal condition in the nose, cured by cauterizing the nasal tissues. Such observations have also been made by others.

That a certain irritability of the nervous system exists in a number of cases, due to functional alterations of the nerve-centres from different causes, inherited or acquired, such as lithæmia, *e.g.*, in which *any kind of peripheral*

¹ Loc. cit.

² New York Medical Journal, September 27, 1890.

³ Berliner Klinische Wochenschrift, No. 33, 1885.

irritation will make manifest this latent depreciation of nerve-function in various ways, has been already stated.

That these manifestations can originate in the irritable nose has been made sufficiently evident; but that the central nervous disease or so-called "neurasthenia" is primarily the result of such nasal irritations I do not think can be demonstrated.

The modification or disappearance of the nervous expressions of such a neurotic condition from suppressing the intra-nasal irritability does not prove that the central disease is due to the latter. That this neurotic state can coexist with pathological alterations of the intra-nasal tissues without any objective symptom of it, has been demonstrated by Dr. Chappel¹ and others, who have observed different expressions of this irritability of the nerve-centres, manifested as the result of intra-nasal operations, even profound nervous prostration and cataleptic conditions, similar to the case I have mentioned.

That the pathological state of the nervous system did not originate from the operation, goes without saying, but the local irritation set up by the latter manifested symptoms of the latent conditions through the transmission to nerve-centres functionally perverted and ready for the development of reflexes.

In the one class of cases the intra-nasal lesion was sufficient to make manifest the latent perversion of function, in the other the additional irritation from the operations was the straw that broke the camel's back. It was simply a difference in the degree of internal resistance, or a difference in the extent of central disease. This is the basis of all reflex neuroses, whether from the nose or from other parts of the organism. To claim that the central disease or neurotic state is caused by the peripheral irritation, whether idiopathic or traumatic, is to make local applications and surgical intervention everything, and to do away with the necessity of constitutional treatment, which is really the foundation of rational therapeutics in the management of nasal reflex neuroses.

Etiology of Nasal Reflex Neuroses in General.—From the facts and theories here presented it can be seen that the various neuroses mentioned are simply expressions of perverted nerve-function of different areas of the cerebro-spinal and sympathetic systems, dependent upon many different causes, and that they can be awakened by the irritation of any sensory nerve. If the location of the peripheral irritation is in the nose, we are dealing with "nasal reflex neuroses." This irritation is transmitted by the sensory filaments of the trigeminus affected to their respective ganglia, where if it meets with healthy resistance and normal nerve-control no neurotic manifestation follows. A continuance of the irritation, however, may eventually bring about disturbance in a healthy ganglion resulting in a reflex vasomotor impulse in the area whose vessels are controlled by that ganglion.

¹ New York Medical Record, 1890.

The afferent sensory impression is transformed into an efferent vaso-motor projection. If the normal nerve-control of the ganglion and other ganglia in correlation with it is already impaired from such causes as have been mentioned, the impression will be reflexly transmitted from ganglia to ganglia, and will produce vessel-disturbances where it meets the least healthy resistance, or in the area controlled by the ganglion whose physiological functions are most impaired.

If the rôle of the sympathetic ganglia is control of vaso-motion, any interference with it would result in more or less pronounced circulatory alterations which could bring about perversion of function in the part affected. To hold that such an effect is due to unhealthy nerve-action is rational; to attribute it to increased physiological activity, or to an "explosion" of stored-up nerve-force, as seems to be the teaching of some physiologists, appears illogical, because in no unhealthy state can there be any increase of physiological activity.

When a function is physiologically altered or perverted, we have a pathological condition, and in all pathological conditions there is disease more or less pronounced. It may not be demonstrable anatomically, but it is there all the same. Circulatory disturbances, vascular changes, can produce more rapid results than any other pathological state. How rapidly circulatory disturbances from emotional influences manifest themselves in immediate syncope, sometimes in the strongest man, the effect of a mental impression on the vaso-motor centres controlling the heart's action and the arterial supply of the whole body! and in this condition there is general impairment of nerve-control, often accompanied by convulsive movements.

Why cannot vaso-motor disturbances limited to a circumscribed region produce a corresponding impairment of nerve-function in this area, with resulting perverted nerve-action, the exciting cause being a limited peripheral irritation instead of a general emotional influence? Whilst I admit that this theory of vaso-motor paresis being the main pathological condition in the production of reflexes has objections, I think it the most acceptable explanation, if the perversion of nerve-function or loss of nerve-control, partial or complete, can be due to alterations of the local circulation.

The immediate result of vaso-motor paresis is contraction of the nerve-arteries (vaso-constriction) and venous hyperæmia, with temporary interference with the circulation. Pain, muscular spasm, and secretory disturbances make up the whole category of these reflexes, and are all manifestations of perverted action of nerves controlling sensation, motion, and vaso-motion. If alterations of their circulation are brought about, their nutrition is impaired and their physiological functions are perverted.

An apparently similar exhibition of functional disturbances may be brought about by direct irritation of a sensory or motor nerve from injury, inflammation, etc., or by indirect irritation whether by electricity or other cause; but this disturbance is due to increased functional activity of the

branches and trunk of the nerve immediately affected, quite a different thing from a perversion of function by a reflected impression through its sympathetic connections.

In the one case it is increase of function accompanied by active or arterial hyperæmia, in the other it is perverted action with passive or venous hyperæmia, and wherever there is venous hyperæmia there is interference with nutrition.

In the former the disturbance is local at the seat of irritation, in the latter it is at a distant point in the area of the ganglion offering least resistance to the transmitted impression.

This impression can be started by any cause in the naso-pharyngeal mucosa that would set up local irritation of the sensory filaments of the trigeminus, and possibly of the sympathetic filaments as well. A reflex vaso-motor alteration anywhere in the naso-bronchial mucous membrane can from the resulting disturbances establish secondary foci of irritation. Hence we may conclude that every part of the respiratory tract may be primarily or secondarily the starting-point of the peripheral irritation, the nasal spaces, however, and especially the region of the middle turbinate, the posterior portion of the inferior turbinate, and the septum opposite, being the area most frequently involved.

Diagnosis.—The diagnosis of “nasal reflex neuroses” is at times very difficult. The test by cocaine anæsthesia in many cases may determine the dependency of the neurotic phenomena upon intra-nasal irritation, but in others this must be done by the exclusion of other probable causes.

The examination of the nose may reveal sufficient deviations from its normal condition to make it the possible source of the peripheral irritation, but this would not confirm the diagnosis.

As already said in regard to asthma, there may be pathological states of the nose accompanying neurotic manifestations without any etiological connection between them, and there may be neurotic phenomena dependent upon nasal irritability without the slightest demonstrable abnormality on the intra-nasal tissues. In these latter cases the excessive irritability usually due to slight vaso-motor changes in the nasal mucosa can often be demonstrated by artificial stimulation with the probe in the reproduction of the reflex, and this test should be always made use of. Its failure, however, does not bar the possibility of a nasal causation, as structural changes may have taken place from long-continued disease that would interfere with a successful demonstration by this means.

Prognosis.—The prognosis in nearly all cases where the nasal causation can be demonstrated is good. But no fixed rule can be laid down in this regard, as we have to take into consideration the peculiarities of each case. The nature of the pathological lesions originating the peripheral irritation, the extent of the secondary alterations in the respiratory tract or other areas affected, the kind of disturbance in the central nervous system, and the length of time it has existed, are all to be regarded in giving an

opinion. The younger the patient, the shorter the time the nervous phenomena have lasted, and the less the nervous system is involved, the more favorable the prognosis.

Treatment.—The treatment is both local and constitutional. In the simpler forms of reflexes due primarily to irritation of the naso-bronchial tract, with but slight functional perversion of the sympathetic nerve-centres, itself due probably to continued peripheral irritation, local treatment alone may effect a cure.

A cough, an asthmatic paroxysm, a neuralgia of the trigeminus, or other reflex phenomenon traceable to nasal disease, either known or unsuspected, can be radically cured by doing away with the source of irritation in the nasal spaces, provided the accompanying central disturbance, which results in these perversions of nerve-function, is principally due to the impression made by continued transmission of the peripheral irritation to hypersensitive nerve-centres.

The transmission of the irritation being cut off by its suppression at the periphery, the nerve-centres are allowed to rest, the perversion of function ceases, nerve-control is restored, and the reflex phenomena disappear. The removal of a nasal polyp, the shrinkage of an enlarged turbinate, the cauterization of peripheral nerve-filaments, etc., will bring about, under these circumstances, seemingly magical results.

But if this functional alteration of the nerve-centres from peripheral irritation, whether from the nose or from distant organs, has existed a long time, if the perversion of nerve-action is due to central changes from inherited or acquired disease, lowering the resistance of the ganglia and making them ever ready to respond to the slightest irritation in a manifestation of reflex phenomena, local treatment alone will not prove efficacious.

The groundwork of rational therapeutics will then be in such constitutional remedies as will restore tone to the nerve-centres, increase their control over nerve-action, and prevent a ready perversion of function. This is all the more important inasmuch as we may safely conclude that the irritation which brings about perverted functional manifestations in an area dominated by this or that ganglion may start in the ganglion itself, if already diseased, from causes the most remote and unexpected.

When nasal disease accompanies such reflex phenomena, it is surely rational to use proper measures to restore the nose to its normal condition, even when the connection between them cannot be proved, as it is a focus of possible peripheral irritation.

Its restoration to proper symmetry, by the resulting improvement in respiration and better oxygenation of the blood, assists in the main object of the constitutional treatment, the toning up of the nerve-centres. The local treatment is therefore to do away with all intra-nasal irritation, whether due to pathological formations or to simple vascular alterations. The treatment of and operations for all pathological formations, such as polyps,

growths, deflections of and cartilaginous and osseous projections from the septum, turbinated hypertrophies, adenoids, etc., will be found described in another part of this work. Their removal is essential to a successful treatment of "nasal reflex neuroses." But it is equally essential to get rid of all intra-nasal irritability, whether accompanied by pathological formation or not. This may be limited to a circumscribed area or areas, and, whilst they vary occasionally in my experience, the middle turbinated tissue and the septum opposite constitute the area most commonly involved.

I have carefully observed hundreds of cases of supposed nasal reflex neuroses, and in a very large majority of them, even when other marked pathological alterations are lacking, the middle turbinate will by anterior rhinoscopy be found approximating so closely to the septum that a very fine probe cannot be passed between the two.

Apply my palate retractor (described under the heading of "methods of examination"), and a puffy appearance of the mucosa over the vomer will be observed which cannot be seen by anterior rhinoscopy nor by the ordinary methods of posterior examination.

Both the approximation of the middle turbinate to the septum and the puffiness over the vomer are abnormal; and such abnormalities should be corrected. Accompanying them there is sometimes turgescence of the inferior turbinates, but not obstructive swelling. If there is any irritability it must be done away with. The application of chromic, nitric, or trichloroacetic acid, or the galvano-cautery, will accomplish these ends. The galvano-cautery is the best agent, because more thoroughly under the control of the surgeon.

A skilful operator can so regulate it that he can get any effect he wishes, great or small, superficial or deep, if he has appropriate apparatus, and this can be done in the posterior as easily as in the anterior nares, provided the palate-retractor is used.

This treatment is sometimes followed by a temporary aggravation of the symptoms, which, however, gradually subside and may entirely disappear. But such a result would in all probability be only a temporary improvement unless proper constitutional treatment were substituted.

That intra-nasal operations, however, are not unattended by some risks, even of aggravating or producing reflexes, and that great care and a judicious selection of cases for such work are necessary, seems to be proved by the reports of different writers. Rethi,¹ Aronsohn,² Semon,³ Rosenberg,⁴ Laurent,⁵ Treitel,⁶ Lermoyez,⁷ report the development of asthma, laryngo-

¹ Internationale Klinische Rundschau. Nos. 51 and 52, 1889.

² Deutsche Medicinische Wochenschrift, No. 17, 1889.

³ Loc. cit.

⁴ Berliner Klinische Wochenschrift, No. 2, 1889.

⁵ Annales des Maladies de l'Oreille, etc., July, 1890.

⁶ Berliner Klinische Wochenschrift, Nos. 16 and 17, 1890.

⁷ Annales des Maladies de l'Oreille, etc., February, 1891.

spasm, amblyopia, neuralgia, Graves's disease, etc., from intra-nasal cauterization, and this of itself demonstrates that intra-nasal irritation can bring about reflex phenomena. But it also teaches that operative measures are to be instituted only after the closest investigation into the condition of irritability of the nasal mucosa, and a careful consideration of the peculiarities of the individual. These unfortunate sequelæ of cauterization were probably due to a too energetic use of the acid or galvano-cautery, for which there is hardly any necessity, as there is no demand for such destruction of the tissues as would result from this method of operating.

Suppression of the peripheral irritation by superficial cauterization that will involve only the peripheral filaments of the sensory nerves and the superficial net-work of blood-vessels is all that is required in my experience, and if one application of the cautery does not prove sufficient it can be repeated; quite as reliable a procedure, and an infinitely safer one.

This local treatment, however, whilst of great importance, is only secondary to the constitutional management of such cases, which should be continued for a long time to insure permanent benefit. The alteration of the nerve-centres is the result of a chronic process, and should be accordingly treated.

Any existing dyscrasia should receive appropriate consideration; syphilis and lithæmia especially should be looked for, and their effects neutralized. Any existing gastric and intestinal troubles should be corrected. Diseases of the genito-urinary organs calculated to keep up the lack of nerve-control in the sympathetic and cerebral centres must have proper attention. The whole object of treatment is to restore tone to nerve-centres of lowered vitality which through impoverishment of nutrition have lost their control over the nerves in the area dominated by them, and exhibit in consequence the perversion of their normal functions known as reflex neuroses.

We wish, then, to improve their nutrition, do away with vaso-motor paresis, and restore nerve-control. As the object is to improve nerve-force and not to lessen it, stimulants in moderation will be very useful. Arsenic, mercury in tonic doses, strychnine, phosphorus, pilocarpine, zinc, quinine, etc., are the remedies I am in the habit of using. Arsenic can be employed in the form of either Fowler's or Donovan's solution, the latter probably the better, and it should be continued until its constitutional effects are produced, when it can be intermitted awhile and then resumed. A valuable prescription in these cases is the following:

R Strychninæ sulph., gr. v;
 Pilocarpin. muriat., gr. vii;
 Hydrarg. bichlorid., gr. iv.—M.
 Ft. pil. no. c.
 Sig.—One after each meal.

This is usually continued for at least three or four months, and the improvement in many cases is rapid and continuous. It fulfils the indications given

above in speaking of the treatment of the asthmatic paroxysm, for the application of drugs in such cases.

Dr. John N. Mackenzie specially recommends the following combination :

R Zinci phosphid., gr. $\frac{1}{6}$;
Quin. sulph., gr. ii ;
Ext. nuc. vomic., gr. $\frac{1}{4}$.
Ft. pil. no. i.
To be taken before meals.

Of course the treatment must be varied to suit the indications of each case, as every individual is a law unto himself, and the observant physician will be guided accordingly.

DISEASES OF THE EYE DEPENDENT UPON DISEASES OF THE NOSE,

AND REFLEX NASAL DISEASE DUE TO OCULAR MALADIES.

BY GEORGE M. GOULD, A.M., M.D.,

Ophthalmologist to the Philadelphia Hospital.

UNLESS very well bred, close neighbors are apt to develop considerable friction in their domestic relations, and this is especially true if the boundaries of their respective lots are not well determined. Besides this, if a house-drain from one empty in the middle of the other's garden, good-fellowship is almost certain to be disturbed. The bearing of this homely rule as to the relations of the eye and the nose is evident. And yet it may be confidently questioned if the practical attention to it in the daily practice of the rhinologist and the ophthalmologist is nearly so routine as is either etiologically justifiable or therapeutically desirable. Judging from the text-books and from current literature, it would appear that the specialist is very prone to think of the organ he is especially and for the time interested in apart from its relations to other organs. The rhinologist thinks only of the nasal cavities, the ophthalmologist only of the eye, whereas the cause of disease as well as the effects may lie in the adjacent organ. It is a matter of the commonest knowledge, of course, that an important canal forms a direct means of intercommunication between the two structures, the fact of a common blood-supply to many parts is known, and the knowledge of the possibilities and of the multiplicity of forms of reflex neuroses is slowly becoming a prerequisite of diagnostic skill. The difficulty lies in practically acting upon and utilizing the vague knowledge we have. It is frequently observed that a bright light produces in many people violent sneezing. I had a patient in whom pressure upon the inner canthus of the eye aroused an immediate sneezing-fit. The lachrymation and other ocular phenomena coincident with measles, a common cold, etc., should keep us alert to suspect more serious and deep-seated pathological interdependencies of the two organs.

It is needless even to recapitulate the anatomical bases of these relations: the mucous membrane of the nose, continuous through the lachrymal excretory apparatus with the conjunctiva, forms the readiest means for

the transfer from one to the other of morbid material; the anterior ethmoidal artery, a branch of the ophthalmic, the capillary supply of the sac and duct, and the anastomoses of the veins from each, all show that vasomotor disturbance in one part may be felt in the other; and the common supply by the trigeminus and other related ganglia shows the mechanism of neurotic associated or anomalous function.

Many attempts have been made to particularize the exact types of disease in either structure that are the effects of disorder in the other. Among the earliest investigators to attempt this, as well as to call attention to the fact of the pathological relations themselves, was Hack, in a monograph on the operative radical cure of migraine, asthma, hay-fever, etc., and of certain ocular complaints. He traces to congestion of the cavernous spaces and the consequent nasal obstruction or stenosis, ocular effects such as conjunctival congestion, swelling of the lids, epiphora, lachrymation, photophobia, etc. Hypertrophy of the nasal mucous membrane, polypi, rhinitis, deviation of the septum, and the like, also induce similar or particular forms of ocular affections.

Berger¹ finds in chronic hypertrophic rhinitis the chief source of ocular troubles, which he divides into five classes: 1, pain, smarting, or burning of the lids or globe, with injection; 2, photophobia; 3, lachrymation; 4, narrowing of the palpebral opening from blepharospasm; 5, ciliary and conjunctival congestion.

Probably the most systematic attempt to particularize the specific groups of these affections and define certain effects in the eyes as due to peculiar nasal anomalies is that of Gradle,² who thus groups the symptoms of the eye:

1. Lachrymation without primary lesion of the tear-passages or of the eye, and due to some chronic abnormality of the nasal passages.

2. Fulness of the lids and itching, possibly with lachrymation and more or less pain in the eyes, and with asthenopia especially marked in one eye. Patients with these symptoms aggravated have also a refraction or muscular anomaly.

In both classes of cases there coexists irritability of the vessels of the nose and of the mucous membrane of the anterior and sometimes of the middle turbinated bone, the submucous cavernous tissue being permanently enlarged. A large majority depend upon what the author terms "irritable nose,"—*i.e.*, liability to sudden engorgement of the blood-vessels from slight causes, with sneezing and a watery discharge. The primary lesion is often polypi, but more commonly it is catarrhal inflammation.

3. Periodic discomfort and itching of the lids, allied to hay-fever, co-existing with conjunctival lesions, at first of follicular enlargement, but finally of the formation of large flat yellowish follicular granules, which disappear in the winter.

¹ Journal de Médecine de Paris, February 28, 1892.

² Archives of Ophthalmology, xvi., New York, 1887.

4. Photophobia, with or without pain in the eyes, these being often bloodshot, with little nasal annoyance, but decided itching.

5. Injection of the pericorneal vessels, together with varying degrees of the above symptoms, chronic and persistent.

6. Acute congestion of the lids, with irritable nose, crysipelatoid in character, subject to recurrence, lasting from two to six days.

7. Sudden œdema of the lids, without congestion, the attack lasting a few hours.

In the present state of science the attempt to trace such sharp etiological and symptomatological groups seems premature, and must lead to a refinement and multiplication of divisions and symptoms savoring not a little of Hahnemannian casuistry. We must be content patiently to gather facts and slowly to systematize from them before any enduring framework of certain science can be established. Hence the present paper will attempt no finished system-building, but will content itself with little more than a mere enumeration and epitomization of the observations that have been put on record.

It is evident that all the facts to be considered fall naturally into two large groups: I. Those starting in pathological conditions of the nose (or adjacent structures commonly included in the rhinological study) and resulting in ocular disease. II. Those commencing in the eye and ending in the nose.

The methods of the communication or causation of these morbid conditions yield in each class the subordinate groups into which all fall,—some-what as follows: 1. The pathological condition may result from congenital or developmental abnormalism. 2. The intermediation may be purely mechanical. 3. The lachrymal excretory apparatus may serve simply as the passage-way for the transfer of morbid material from one organ to the other. 4. The morbid condition may be transferred by direct continuity and extension of tissue, of the mucous membrane, the skin, muscles, vessels, periosteum, or bone. 5. The relation may be established by neurotic reflex.

The consideration of the last group, the highly important and interesting class of nasal reflexes ending in ocular diseases, is presented by another writer in this work. It is my duty to review the four other groups, including those reflex phenomena starting in the eye and ending in the nose.

In passing, it may be said that it is often impossible to distinguish clearly between symptoms that might be classed as nasal reflexes or as due to vascular or other influences. Many that have been considered reflex are doubtfully so. A number of such cases are reported by Lieven,¹ but in these instances the channel whereby the ocular affections become secondary to nasal abnormalities is chiefly neurotic in character. Parenthetically allu-

¹ Deutsche Medicinische Wochenschrift, December 1, 1892.

sion may be made to a method of differential diagnosis often serviceable in such cases. This consists in the application of cocaine to the nasal cavities. If the ocular symptoms cease, the lesson is obvious,—though even here some fallacy may be hidden, owing to the action of cocaine upon the capillaries and their congestion, with distant effects not entirely neurotic. Practically, of course, the distinction is of little moment, and the excellent procedure is allied in usefulness to that too little employed by physicians, consisting in the paralysis of the accommodation to differentiate between headache and other reflexes, whether due to ocular or to other causes. In reviewing the literature at command, one is struck by the fact that in the vast majority of cases the nose is the point of departure of the morbid process; the eye more seldom setting up disease in the nose,—the excretory lachrymal apparatus, of course, being considered in its entirety as an ocular structure. In conjunctivitis, even of the purulent varieties, the primary affection of the eye does not infect the nasal cavities. The greater sensitiveness of the eye to pathogenic micro-organisms is a noteworthy fact. The nasal mucous membrane is not for them so favorable a breeding-ground. Bresgen¹ speaks of this, noting that in primary acute conjunctivitis the nose is seldom affected, whilst in acute coryza the eye is affected. He cites Moauro as having found in two cases trachomatous granulations in the adenoid tissue of the lachrymal canals. The diphtheritic membrane but rarely forms on the eyes, whilst croup and erysipelas do not extend from one structure to the other, nor does tuberculosis of the conjunctiva. Knapp² has described a case of lupus of the nasal fossæ propagated towards the lachrymal canal and producing symptoms of dacryocystitis. On the other hand, Bresgen says syphilitic coryza never extends to the conjunctiva.

I.—PATHOLOGICAL CONDITIONS OF THE NOSE SECONDARILY AFFECTING THE EYE.

CONGENITAL OR DEVELOPMENTAL ANOMALIES OF THE NOSE OR ADJACENT STRUCTURES INJURIOUSLY AFFECTING THE EYE.

Berger³ reviews the congenital malformations of bones forming the pneumatic spaces surrounding the orbit and their influence on the form and functions of the eye. The distance between the eyes may thus be subnormal, with consequent insufficiency of the internal recti, or divergent strabismus. If the ethmoid is abnormally large, corneal astigmatism may result from the abnormal insertion and function of the recti muscles. If the anterior ethmoid cells are over-developed, they may occasion stenosis of the osseous naso-lachrymal canal. Reference is made to Nieden, who observed congenital narrowness of this canal, with epiphora, etc., in several

¹ *Journal de Médecine de Paris*, February 28, 1892.

² *New York Academy of Medicine*, January 20, 1890.

³ *Journal de Médecine de Paris*, February 21 and 28, 1892.

members of one family. Over-development of the sphenoid is in the same way charged with producing congenital optic atrophy, and the charge has been proved by post-mortem examination.

Berger further discusses the relation of discoloration of the optic nerve with or without diminution of the visual acuteness, etc., and of complete atrophy, as due to compression of the optic nerve in the optic canal. The atrophy termed "Leber's disease" arising in persons from eighteen to twenty years of age he considers due to the fact that at this age the growth of the sphenoid bone ceases. The irregular development of other bones of the base of the skull, exercising compression on different parts of the nervous system, would explain other symptoms of Leber's disease.

Ziem¹ contends that when the nasal cavity and the ethmoidal cells are developed asymmetrically, and the distances of both orbits from the median line are unequal, it follows when the eyes converge towards the median line that the performance of adduction differs for each rectus internus muscle, and this may lead to asthenopia and finally to strabismus. Ziem further states that as the breadth of the floor of the orbit is in proportion to the distance of the lateral and median walls of the maxillary cavity, asymmetry of the orbit must be brought about by asymmetry of the maxillary cavities. Welcker found this proportion actually present in twenty-one out of thirty-seven skulls which showed oblique direction of the nose. Ziem demonstrates the frequency of astigmatism with asymmetry of the face and orbit in chronic obstruction of the nose on one side.

Dunn² says that it is in the highest degree probable that continuous nasal obstruction in early childhood delays the development of the orbital plate of the ethmoid bone, as well as of the rest of the ethmoid bone, it being an integral part of this bone, and, if so, the orbit is necessarily prevented from developing properly. He finds in this the explanation of the fact that the majority of children who have suffered from nasal obstruction, and from post-nasal adenoids as the chief cause of this condition, are far-sighted, to a degree higher than can be explained by inheritance. The eyeball being in the orbit is influenced in its development within certain limits, though the laws of inheritance stamp their plan upon it while it is in embryo, by the development of the orbit. And here, again, in the faulty development of the orbit is to be found the explanation of some of those sporadic cases of astigmatism with which one meets,—certain cases not inherited, and which cannot be explained by influence of previous inflammatory conditions of the cornea, etc. He cites a case in support of this view.

¹ *Monatsschrift für Ohrenheilkunde*, 1883, Nos. 2, 3, 4, 5.

² *Virginia Medical Monthly*, September, 1889.

DISEASES OF THE SPHENOID, ETHMOID, THE FRONTAL SINUS,
ANTRUM OF HIGHMORE, ETC.

An important work in relation to this department is that of Berger and Tyrmann¹ on the diseases of the sphenoidal and ethmoidal sinuses and their relation to diseases of the eye. Our allotment of space permits hardly more than an allusion to their extended studies and conclusions. Caries and necrosis of the sphenoid may be attended by sudden unilateral blindness from perineuritis of the optic nerve in the optic canal; thrombosis of the cavernous sinus and of the ophthalmic vein from thrombosis of the venous sinus of the sella turcica. Injuries of the sphenoid may result in continuous leaking of the cerebro-spinal fluid; injury of the internal carotid within the cavernous sinus, with consequent pulsatile exophthalmos; injury of the optic nerve, with blindness by prolongation of the fissure to the canal; injury to the second and third branches of the trigeminal, with anæsthesia of the parts they supply. Caries of the ethmoid may be followed by orbital abscess or emphysema, and traumata of the ethmoid by leaking of the cerebro-spinal fluid, orbital emphysema, nasal hemorrhage, etc.

In this connection may be mentioned the case of A. Emrys-Jones,² in which atrophy of the optic nerves was associated with the dropping of fluid from the nostril. Seven cases of a similar nature are on record,—viz., one by Elliotson,³ one by Baxter,⁴ one by Paget,⁵ one by Nettleship,⁶ two by Priestley Smith,⁷ and one by Leber.⁸

Leber, whose case is the last put on record before that of Emrys-Jones, analyzes those previously published, and comes to the conclusion that the fluid was cerebro-spinal, and probably the product of a vascular organ especially adapted for secretion, as the choroid plexus of the ventricles. Brain-symptoms were present to some extent in six cases out of eight; and in some a distinct connection could be traced between the headaches, giddiness, etc., and the stoppage of fluid. Atrophy of the optic disk was present in all the cases that were examined; in several instances it followed optic neuritis. In the case of Jones the atrophy does not seem to have followed neuritis. It developed very slowly, and, although complete in the right eye, it made slow progress in the left. The coincidence was noted that the optic nerve that was the most atrophic was always on the same side as that of the most copious discharge.

Wood⁹ gives the details of two cases of nasal hydrops, the first

¹ Die Krankheiten der Keilbeinhöhle, etc., 1886.

² Ophthalmological Review, vol. vii., 1888.

³ Medical Times and Gazette, 1857.

⁴ Brain, 1882.

⁵ Transactions of the Clinical Society, 1878.

⁶ Ophthalmological Review, 1883.

⁷ Ibid.

⁸ Abstract in Ophthalmological Review, 1883.

⁹ New York Medical Journal, September 6, 1890.

associated with reddened conjunctiva, epiphora, asthenopia, amblyopia, and photophobia. The discharges occurred daily, usually in the morning, and lasted from three to four hours. Sneezing and formication were sometimes symptoms. The discharge from the nose was watery at first, but just before stopping for the day became opalescent and thicker. That from the eyes was like tears. There were deep excavations and pallor of the disks, with yellowish-white bands partially about the depression. Continued nasal treatment (snaring portions of the middle turbinated) and internal medication gave much relief, especially of the subnormal vision. In the second case a prominent symptom was excessive sneezing. The nasal discharge had existed ten years. The ocular symptoms were in this case much less pronounced. Removal of polypi was followed by complete cure of all symptoms.

The author discusses the theory of Mules as to the etiology of this affection, viz., that the coexistence of optic atrophy and hydrorrhœa from eye and nose is a coincidence, and inclines to think both conditions dependent upon a vaso-motor paresis.

In a private letter Dr. Harrison Allen, of Philadelphia, cites an unreported case in which necrosis existed at the os planum over the posterior ethmoid cells, associating in an intimate manner a lesion of these cells with the connective tissue of the orbit.

Panas¹ says that inflammations of the frontal sinus commonly appear at the border of the orbit, and are not by any means always dependent upon nasal affections. The chief diagnostic indication is violent frontal and supra-orbital neuralgia. The author describes the best operative methods for trephining and treating the sinus.

Empyema of the antrum of Highmore may, in passing, be mentioned as sometimes resulting in serious ocular complications. These may come about as results of reflex neurosis, or of pressure, even of invasion of the orbit, but usually by the transfer of purulent material through the nose and the lachrymal duct. In addition to the natural sequelæ, such as lachrymo-nasal disease, conjunctivitis, etc., there have been mentioned iritis, panophthalmitis, and orbital abscess. Jeauty in his Bordeaux thesis (March, 1891) has recapitulated the histories of twenty-two reported cases of Highmorean empyema, and Hajek² gives the details of twenty-nine observed cases.

Ziem³ says that Killian and others have expressed the opinion that a narrowing of the visual field with amblyopia accompanied by a purulent secretion of the nose pointed rather to a disease of the ethmoidal sinuses, whereas formerly these symptoms were grouped under those of purulent diseases of the antrum of Highmore. In Berger and Tyrmann's monograph

¹ *Le Progrès Médical*, May 10, 1890.

² *Internationale Klinische Rundschau*, October 23, 1892.

³ *Berliner Klinische Wochenschrift*, 1888, vol. xxv. pp. 747-51.

on the subject, no connection is found to exist between the presence of pus in the antrum of Highmore and the narrowing of the visual field. Ziem admits that in formation of pus in the maxillary sinus, as well as in the sphenoidal sinuses and the accessory cavities of the nose, a narrowing of the visual field may result, and he quotes a case to that effect. He does not believe that a reflex from the tumefied nasal mucous membrane or a marked irritation of the special reflex organs which, according to Haack, are located in the mucous membrane of the nose, enters into the question, but it is not improbable that the tumefaction of the antrum of Highmore produces a temporal neuralgia, and also a stimulation of the vaso-motors of the choroid and ciliary body. He quotes a remarkable observation made by Marekworth¹ of a case of glaucoma resulting from a prolonged application of cocaine to the nasal mucous membrane. He believes that acute congestion preceded by a venous stasis of the ciliary plexus was the cause of the glaucoma. He regards the case as analogous to cases of eye-trouble following applications of the galvano-cautery. He has observed a series of glaucomata in which a very marked coexisting purulent rhinorrhœa was noted. In several cases of this kind iridectomy performed by himself and other very experienced practitioners to overcome the glaucomatous process was ineffectual.

Grünwald² is unable to confirm Ziem's contention that empyema of the antrum produces limitation of the field of vision. He has never found it so in his cases. Schmidt-Rimpler³ suggests that the supposed contraction of the field is due to a natural mistake in making the perimetrical diagnosis. Grünwald has never found any objective ocular symptoms due to the nasal trouble, although he has frequently heard patients complain of asthenopic difficulties coincident with the nasal disease, and he explains the fact as arising from hyperæmia and irritability of the eyes due indirectly to the excess of blood and to the morbid conditions of adjacent parts, and increased by the direct influence of continued accommodation and ocular work. He also speaks of psychic causes as well as the physiological ones, and he uses the terms "psychic asthenopia" and "psychic contraction of the visual fields."

Schaeffer and Hartmann, as quoted by Berger,⁴ have described cases of orbital abscess following coryza. The suppurative inflammation of the ethmoidal cells served as the method of communication between the coryza and the orbital abscess.

Ponfick⁵ had a case of meningitis following nasal disease in which there was a solution of continuity in the bony walls between the sphenoidal sinus and the cranial cavity. A similar explanation is used by Berger to account for a subacute attack of retro-bulbar neuritis.

¹ Knapp u. Schweigger's Archiv, 1887, B. xvii. S. 452.

² Die Lehre von Nasenerkrankungen, etc., 1893.

³ Deutsche Medicinische Wochenschrift, No. 24, 1892.

⁴ Journal de Médecine de Paris, February 28, 1892.

⁵ Centralblatt für die Medicinische Wissenschaft, No. 8, 1882.

Berger¹ says that the limitation of the field of vision, sometimes met with in the course of nasal disease, may be caused by an affection of the optic nerve propagated by direct continuity of tissue from the nose to neighboring cavities.

MECHANICALLY-CAUSED ABNORMALITY OF THE EYES STARTING
IN THE NOSE, OR IN COMMUNICATING AND ADJACENT STRUCTURES.

These, for the sake of systematic completeness, may be incidentally mentioned in passing, though they readily suggest themselves to the mind of the ophthalmic surgeon. No operator, for example, would perform a cataract or other major operation upon the eye if the patient were subject to paroxysms of sneezing or coughing whereby the post-operative healing processes would be greatly endangered. All have seen instances of capillary hemorrhage, subconjunctival or even retinal, produced or increased by these effects of such irritability of the respiratory passages. I had a patient with what was perhaps a unique illustration of mechanical effect. Blowing the nose had forced the air so violently through the duct that the mucous membrane of the sac had ruptured, and the skin was dissected up from the side of the nose and orbital border near the inner canthus, and formed there a large tense bulla or atmospheric tumor.

Berger and Tyrmann² discuss the symptoms of sphenoidal and ethmoidal tumors that augment the cavities of the sinuses, causing atrophy of the walls and compression or invasion of the orbits, compression (with blindness) of the optic nerve, expression of the eyeball, etc. Bull³ also discusses the symptoms and treatment of tumors of the orbit secondary or consecutive to tumors of the neighboring bony cavities.

It is hardly necessary to mention the occurrence of intra-nasal tumors, hypertrophies, polypi, traumata, etc., which by pressure close the nasal outlet or lumen of the canal, the sac, or, in rare cases, directly or mediately act on the eyeballs themselves, even pushing them aside so as to produce the deformity known as frog-face. Nieden⁴ reports several such cases: 1. Polypi of the upper part of the nasal cavity perforating first into the left and afterwards into the right orbit; exophthalmos of both eyes; death with cerebral symptoms. 2. Myxo-sarcoma of the mucosa of the superior nasal sinus, rupture of the ethmoid plate, extension into the cranial cavity, and from there to the base of the brain and into both orbits; neuro-retinitis, double exophthalmos, blindness, death in coma; post-mortem examination. 3. Chronic empyema of the right frontal sinus and ethmoid labyrinth; rupture into the right orbit; dislocation of the eyeball outward; direct communication of the abscess with the nasal antrum.

¹ Journal de Médecine de Paris, February 21, 1892.

² Die Krankheiten der Keilbeinhöhle, etc., 1886.

³ New York Medical Journal, December 19, 1891.

⁴ Archiv für Augenheilkunde, vol. xvi., 1885-86.

Priestley Smith¹ describes a case in which a morbid growth in the nasal cavity was the cause of blindness in both eyes. Removal of the growth, a tumor of some kind, from the back of the nose, was followed by restoration of normal vision in one eye. On account of the fact that the optic disks presented no inflammatory or other changes long after one eye was completely blind, it is thought that pressure was the direct cause of the blindness.

Baptie² reports a case in which injection of a nasal polyp by another surgeon (doubt therefore existing as to what was injected) probably resulted in inflammation of the lid and parts adjacent to the eye, something like herpes frontalis, together with iritis and optic atrophy. In another case a huge rhinolith of the left nostril culminated in a profuse purulent discharge from the nasal side of the left orbit, and destruction of the left eyeball.

Nasal tumors may, of course, press on the tear-duct or occlude its intranasal orifice and thus cause epiphora and all the phenomena of lachrymal obstruction.

Harrison Allen³ says that the anterior end of the middle turbinated bone, either by displacement of the bone or by hyperplasia of the mucous membrane, may make injurious pressure upon the lachrymal bone and thereby create a congested state of the lachrymal tube which will lead to obstruction. He reports two cases of this condition in which the lachrymal abscess and epiphora were cured by operation upon the local nasal abnormality.

One does not know where to classify cases of exophthalmic goitre like that reported by Musehold,⁴ cured by removal of hyperplastic growth of the inferior turbinated bone. He considers the phenomenon to be that of a vaso dilator neurosis. Reports of five similar cures are epitomized by Musehold.

OCULAR DISEASES CAUSED BY THE TRANSFER OF PATHOGENIC MATERIAL FROM THE NOSE TO THE EYE BY WAY OF THE LACHRYMAL CANAL.

I suspect that this fact is of far more importance than has heretofore been supposed. All ophthalmologists have doubtless had cases in which suppurative inflammation of a single eye, as, for example, in gonorrhœal ophthalmia or ophthalmia neonatorum, despite the most rigid isolation and protection of the healthy fellow-eye, was followed by infection of this latter. It seems strange that such facts had not long ago directed attention to the nose as the half-way-house, and to the duct leading to the conjunctiva as the further route, of the morbid germs. The caution is wisely emphasized to keep the patient's fingers away from the eyes, and in a dozen ways prevent inoculation of the eye by other contact-methods. But nose-picking is far

¹ Ophthalmic Review, vol. ii., 1883.

² Canada Medical Record, October, 1892.

³ Proceedings of the Philadelphia County Medical Society, vol. xi., 1890.

⁴ Deutsche Medicinische Wochenschrift, February 4, 1892.

more common than eye-rubbing, so that it becomes probable that even the primary infection may have first reached the eyes by the nose. Mackenzie¹ merely mentions purulent nasal catarrh intercurrent with purulent ophthalmia, and (p. 296) speaks of patients with gonorrhœa as having infected the nostrils. Despagnet² also alludes to the fact. The suggestion cannot be amiss that antiseptics of the nasal cavities and prophylactic cautions should form part of the routine prevention and treatment of eye-diseases in patients with gonorrhœal disease. Nasal disease with copious mucous or muco-purulent nasal discharge, coexisting with suppurative conjunctivitis, is suggestive that the latter is dependent upon the former malady.

A number of authors have noted the synchronous or consequent diseases of the eye in nasal disease with ozæna as a prominent symptom. It is, of course, impossible to say how often such nasal conditions may produce dacryocystitis and other diseases of the lachrymal excretory passages. Fischer³ traces to this cause several cases of glaucoma, two of papillitis, several each of iritis and of hypopyon-keratitis, and many of trachoma and chronic conjunctivitis.

In a private letter Dr. S. D. Risley, of Philadelphia, writes me, "It has often seemed probable that the recurring attacks of inflammation of the cornea and conjunctiva of young children sustained an important relation to disease of the nose and upper pharynx, so constantly present in the neglected children that crowd our clinics. In making this suggestion I am not unmindful of the large group of obviously strumous children in whom all the mucous membranes are subject to disease as a part of the common expression of their malnutrition."

Among the first to emphasize the causal relation of nasal catarrh to conjunctival catarrh was Bresgen,⁴ who says that the ocular sequence will not disappear without treatment of the primary nasal disease. Similar observations have been made by Moldenhauer,⁵ Rumbold,⁶ Cheatham,⁷ Augagneur,⁸ Bucklin⁹ (with details of four cases of trachoma, opacity of the cornea, etc.), Kolipinski¹⁰ (with details of nineteen cases of conjunctival inflammations, phlyctenular ulcers of the cornea, etc., cured by nasal treatment alone), Hendrix,¹¹ Dowling¹² (details of three cases), and many others.

¹ Diseases of the Throat and Nose, p. 295.

² Recueil d'Ophthalmologie, September, 1889.

³ Zusammenhang von Augen- und Nasen-Krankheiten, New-Yorker Medizinische Presse.

⁴ Der chronische Nasen- und Rachen-Catarrh, 1881, Band i., and later, Grundzüge einer Pathologie, etc., 1884.

⁵ Die Krankheiten der Nasenhöhlen, etc., Leipzig, 1887.

⁶ St. Louis Medical and Surgical Journal, 1886.

⁷ American Practitioner and News, April 2, 1887.

⁸ Revue Médicale de l'Est, October, 1888.

⁹ Medical and Surgical Reporter, May 18, 1889.

¹⁰ Medical News, xlv., September 27, 1884.

¹¹ St. Louis Medical and Surgical Journal, January, 1886.

¹² Cincinnati Lancet Clinic, xxiii., 1889.

Dunn¹ says, "In the vast majority of cases of children suffering from phlyctenular troubles there will be found a coincident rhinitis, and behind this unhealthy adenoid vegetations."

In a private letter Dr. James Wallace, of Philadelphia, gives it as his opinion that phlyctenular conjunctivitis may be the result of acrid discharge forced into the eye by sneezing or blowing the nose. "I have seen phlyctenular disease yield to nasal treatment when local treatment of the eyes was of no avail."

Hamilton² found in one hundred and six cases of post-nasal growths that eye-diseases coexisted in fifty-one: in twenty-two there was catarrhal, in seven follicular, and in sixteen granular conjunctivitis, and in six there was blepharitis.

Gordon³ argues that there is a special form of conjunctival disease dependent upon chronic inflammation of the intra-nasal tissues. The palpebral conjunctiva is thickened and rough, with tarsal complications, photophobia, lachrymation, etc. The diagnosis is confirmed by the coexistence of chronic rhinitis with hypertrophy of the nasal mucous membrane, and the discharge of a thin, watery mucus. Illustrative cases are detailed.

Masini⁴ contends that atrophic rhinitis may be the cause of a sclerotizing or atrophic disease of the conjunctiva. He adduces two cases in which treatment of the nasal difficulty gave relief to the ocular sequence.

Dr. Lewis H. Taylor⁵ describes cases of granular lids with pannus, etc., not improved by local treatment, coexisting with enlargement of the lower turbinated bones, atrophy of the nasal mucous membrane, occluded passages, etc. Cauterization of the turbinated bones and local treatment resulted in improvement of the ocular condition.

Bucklin⁶ contends that rebellious trachoma is often dependent upon disease of the nasal passages, and inclines to accept the theory that the obstructed nasal passages retain the original infectious matter uninfluenced by local ocular treatment, and there is thus constant reinfection of the conjunctiva through the lachrymal duct. Several cases are described which, after long treatment of the lid and corneal trouble, were relieved by cure of the nasal obstruction.

Despagnet⁷ says that in old cases of cured trachoma, often subacute attacks of keratitis, etc., are lighted up without apparent cause, but that on the morbid nasal mucous membrane may be found microbes identical with those found in granular conjunctivitis, and that inoculation experiments with them result in the production of granulations like those of the conjunctiva in man.

¹ Virginia Medical Monthly, September, 1891.

² Transactions of the Intercollegiate Medical Congress of Australasia, 1889, ii. 779.

³ Journal of the American Medical Association, v., 1885.

⁴ Bollettino di Oculistica, viii. 11, 12.

⁵ Journal of the American Medical Association, November 17, 1888.

⁶ New York Medical Times, May, 1887.

⁷ Recueil d'Ophthalmologie, September, 1889.

Trousseau¹ has had eleven cases of grave ulceration of the cornea that he believed dependent upon atrophic rhinitis or simple ozæna, without any apparent alteration of the lachrymal ducts. The causal relation is considered certain because of the existence of a special coccus (Loewenberg) in the secretions of ozæna, which, through the intact lachrymal ducts, attacks any incipient ulceration of the cornea. With disinfection of the nose the corneal ulcers proceed to a cure under the usual treatment.

Nieden² says, "We see still further the fact admitted by all ophthalmic surgeons, that another form of infectious disease, *phlyctenular keratitis*, almost invariably has its origin in a disease of the nose. Here we see in the preliminary stage more or less swelling, redness, increased secretion, and the formation of ulcers around the edges of the nostrils. The upper lip participates in the process of infiltration and begins to swell. The nose, too, as a whole tumefies, becomes red, the thickening of the mucous membrane extends well into the posterior portion of the nose, and hemorrhage follows even a gentle touch with the probe. The margins of the nostrils are covered with dry, hard crusts, which, when removed, reveal a more or less deep, excoriated, ulcerated, and bleeding surface. . . . The trouble with the eyes can only be permanently and certainly relieved when simultaneously the pathological condition of the diseased mucous membrane of the nose has been treated and restored to its normal state."

"There is no doubt," says Niden further, "that the products of ozæna exercise a directly noxious influence upon affections of the cornea, for we invariably expect suppurating ulcers with the characteristic infectious symptoms from extension of the disease whenever ozæna is present in cases of traumatism even of the epithelium of the cornea, and this even when there has never been any blennorrhœa of the lachrymal sac, which of itself is quite sufficient to excite the infection."

Masini³ also contends that corneal disease may result from ozæna. The corneal difficulty consists in ulceration of the limbus proceeding rapidly towards a grave termination, and upon this ordinary treatment of the eye is without result; but it is immediately cured by the appropriate nasal treatment. He also describes another kind of keratitis, a sort of parenchymatous affection of the cornea dependent upon ozæna. It begins with slight lachrymation with increasing photophobia, a bluish circle surrounding the cornea, accompanied by ciliary pain, and whitish spots in the cornea, somewhat resembling interstitial keratitis. Treatment of the ozæna cuts the corneal difficulty short. The author cites the case of a child who for three and a half years endured without inconvenience the presence of a pebble in the right nostril; a fetid purulent discharge resulting, the child complained of violent pain in the right nostril, with lachrymation and conjunctival

¹ Archives d'Ophthalmologie, ix., 1889.

² Archiv für Augenheilkunde, Bd. xvi., 1885-86.

³ Bollettino di Oculistica, viii. 11 and 12.

congestion, photophobia, photopsia, etc. With the removal of the foreign body from the nostril all these symptoms disappeared.

Dr. Lewis H. Taylor¹ describes a case of chronic disease of the cornea and conjunctiva that had existed for thirty years, unimproved by local treatment. He found the mucous membrane over the turbinated bones swollen, and an offensive yellowish discharge, with occlusion of the nares. Local treatment of the nasal disease speedily ended the ocular complications. In a private letter Professor William F. Norris, of Philadelphia, says that he has had frequent cases of nasal disease causing purulent inflammation of the lachrymal duct.

Hendrix² reports the case of a young lady with tinnitus, blind in the right eye from conjunctival and corneal disease, the other staphylomatous, myopic, and nebulous. The mucous membrane of the right naris and the right middle turbinated was highly congested, causing interference with respiration, and the pharynx was congested and granular. Local treatment of the naso-pharynx, the author avers, brought to the right eye, which had been blind, ability to read large print, and entirely cured the staphyloma, myopia, and nebulous cornea of the left eye.

DISEASES OF THE LACHRYMAL EXCRETORY APPARATUS.

The chief symptom of disease of the lachrymo-nasal canal is excess of tears in the eye, followed or complicated by epiphora, lachrymal conjunctivitis, dacryocystitis, etc. It is evident that these symptoms and the single condition underlying them—stenosis or occlusion of some part of the drainage-system—may be primarily due either to ocular or to nasal disease. The ocular causes will be considered later. They are comparatively infrequent and unimportant, the nose being usually the *fons et origo mali*. On the part of this organ the difficulty may be due—1, to mechanical obstruction of the intra-nasal end of the lachrymal canal; or, 2, the disease of the duct and sac may be the result of morbid material passing from the nares; or, 3, it may be due to an extension from the nose, by simple continuity of tissue, of inflammatory or morbid processes.

The effects upon the eye from lachrymal obstruction are too varied to mention, and may be found in detail in the best ophthalmological works. The healing of intercurrent diseases of the eye is hindered or rendered impossible by this cause, and positive production of multiform disease of the conjunctiva or cornea is frequent. Thus, Fieuzal³ reports seven cases of multiple corneal ulcers associated with constriction of the lachrymal ducts or obliteration of the puncta. All were cured by measures directed against the lachrymal troubles.

The importance of general syphilitic disease and its treatment is em-

¹ Journal of the American Medical Association, November 17, 1888.

² St. Louis Medical and Surgical Journal, January, 1886, p. 20.

³ Gazette des Hôpitaux, xlv., 1872.

phasized by Watson,¹ who had a case of unilateral obstruction of the duct, with ozæna, due to syphilitic rhinitis, and from a study of this and similar cases he thinks that the constitutional treatment of lachrymal obstructions is quite as important as the mechanical measures, and that the condition of the whole tract of mucous membrane from the conjunctiva to the nostrils is at fault in the worst forms of mucocele; that the obstruction, in fact, depends rather upon a uniform narrowing of the whole extent of the series of channels, than upon a stricture limited to one or two points. When there is a strongly-marked syphilitic or scrofulous swelling of the mucous tract, it will be very difficult to overcome the epiphora, or to heal up the fistulæ of an abscess, without very careful attention to constitutional treatment.

De Schweinitz² also had a case similar to that of Watson, from which he concludes that local treatment without general medication is ineffectual.

Bresgen,³ as quoted by Nieden,⁴ regards the connection between the stricture of the lachrymal duct and diseases of the nasal mucous membrane as so close that he declares that every lachrymating patient, even when he first visits an ophthalmic surgeon, ought to be immediately referred to a rhinologist for a scientific examination, and for eventual treatment of the nose.

Nieden⁵ says that in coexisting nose- and eye-affections two different categories of processes are concerned,—namely, those that extend by way of the naso-lachrymal canal, and those in which, the nerves of the mucous membrane of the nose being irritated, the eye and its surroundings sympathize by reflex action. In about one-half of the cases of lachrymation the cause lies in the visual organ and its appendages, and depends upon the avenues of deflection of the tears,—namely, through the canaliculi, the lachrymal sac, and the orifice of the naso-lachrymal duct; whereas in the other half of the cases the epiphora is due to affections located in the canal—stenosis, stricture, or an inflammatory swelling of the membrane, particularly at the nasal opening. In the large majority of the former cases the stenosis is located at the entrance of the lachrymal sac, and is complicated with ectasy of the sac, whereas in stenosis of the duct or of the nasal orifice abnormal dilatation and muco-purulent collection in the lachrymal sac are more rarely encountered. According to Nieden, hereditary influences are to be considered in these affections of the deviations of the tears, *i.e.*, an anomaly of the nasal framework common to parents and children, with a dependent modification of the calibre of the naso-lachrymal duct. As far as the relation existing between ozæna and disturbance in the

¹ Medical Times and Gazette, London, 1878, i. 58.

² Transactions of the Philadelphia County Medical Society, 1892.

³ Grundzüge einer Pathologie und Therapie der Nase, etc., 1884.

⁴ Archiv für Augenheilkunde, Bd. xvi., 1885–86.

⁵ Ueber den Zusammenhang von Augen- und Nasenaaffectionen, Archiv für Augenheilkunde, Bd. xvi. S. 381.

deflection of tears is concerned, Nieden suspects, relying upon sixty-seven cases he has observed, that the chronic inflammation of the Schneiderian membrane may be the cause of the lachrymation, but that the formation of the chronic rhinitis is brought about principally by the absence of the lachrymal fluid, the secretion of the mucous membrane of the nose thus more readily becoming dried and decomposed. He also says that catarrhs of the mucous membrane of the nose complicating trachoma occur only when the mucous membrane of the naso-lachrymal duct participates, and in the cavity of the sac a focus is established for microbic infection.

However rare it may be, it is doubtless more frequently the case than is usually supposed that occlusion of the intra-nasal orifice of the lachrymal duct by local anomaly or disease too often fails to be recognized, and that many obstinate cases of dacryocystic disease have been treated in vain from the ocular side, when the nasal speculum would have revealed the primary source of the mischief. At a meeting of the Philadelphia County Medical Society Dr. R. W. Seiss¹ spoke of having seen a number of cases in which unskilled use of the nasal cautery had closed the mouth of the duct; and at the same meeting Dr. De Schweinitz reported a case of local closure presenting an impassable barrier to the outflow of tears, though permeable by the fluids used in a syringe. Bresgen² speaks of this cause of duct-obstruction; also Masini,³ Despagne,⁴ Berger,⁵ and Gruening.⁶

Bresgen⁷ and Herzog were among the first to show the nasal origin of diseases of the lachrymal duct and sac. Bresgen says that stricture of the naso-lachrymal canal may be treated unsuccessfully for months and even years with the sound, whereas proper treatment, frequently only two weeks in duration, of the chronic rhinitis which always exists with closure of the lachrymal duct, removes the long-existing so-called stricture as if by magic, restores the naso-lachrymal duct to its proper functions, and assists in rapidly healing inveterate inflammations of the conjunctiva.

Herzog's⁸ opinion is that a certain reciprocity exists between the mucous membrane of the conjunctiva and that of the nose, by way of the naso-lachrymal duct. According to his experience, certain eye-affections, "particularly those due to scrofula," recover much more rapidly when at the same time a suitable treatment of the chronic catarrh of the nose is instituted. So far as the accessory cavities of the nose are concerned, it is frequently observed that diseases of these cavities may extend to the "ways of deflection of the tears." An empyema of the antrum of Highmore may

¹ Transactions of the Philadelphia County Medical Society, 1892.

² Grundzüge einer Pathologie, etc., Wien und Leipzig, 1884.

³ Bollettino di Oculistica, viii. 1.

⁴ Recueil d'Ophthalmologie, September, 1889.

⁵ Journal de Médecine de Paris, February 21, 1892.

⁶ New York Medical Record, January 30, 1886.

⁷ Deutsche Medicinische Wochenschrift, 1884, Bd. x., S. 133.

⁸ Mittheilungen des Vereins der Aerzte in Steiermark, 1884, S. 19.

rupture into the naso-lachrymal duct, and empyema of the frontal sinus into the lachrymal sac. Hydrops of these cavities is followed by compression of the naso-lachrymal canal or of the lachrymal sac. Tumors, likewise, originating in the neighborhood of the naso-lachrymal canal, may compress this duct; malignant tumors may perforate it.

Gruhn reports that in the cases examined during two years the affections of the naso-lachrymal canal were frequently accompanied by a mucopurulent secretion. Strictures were frequently found at the nasal orifice of the naso-lachrymal canal; on introducing the sound the naked bone could be felt. He reports thirty-eight cases of patients with dacryocystoblennorrhœa associated with atrophic rhinitis and pharyngitis, deflection of the nasal septum, the presence of spurs, and hypertrophy of the turbinated bones. In nineteen cases fetid atrophic rhinitis was present; in eight cases atrophic rhinitis without fetor; in six cases atrophic rhinitis without fetor, combined with hypertrophic rhinitis; in four cases hypertrophic rhinitis. He regards the affections of the nose as the primary trouble in all probability, and the disease of the lachrymal duct as the complication.

Hansen Grut¹ gives as the most frequent cause of blennorrhœa of the lachrymal sac a recurring coryza which obstructs the flow of tears through the duct, gradually dilating the lachrymal sac and rendering the secretion septic; all other causes are relatively rare. Organic strictures are much more frequently the sequelæ than the cause of blennorrhœa. Sooner or later acute dacryocystitis is established, and the author believes that this latter condition can be caused only by a chronic blennorrhœa of the lachrymal sac.

Harrison Allen,² a most scientific observer, concludes that lachrymal obstruction and chronic nasal catarrh are not infrequently associated. The duct is obstructed in two classes of cases only,—namely, in chronic nasal catarrh in which there are submucous infiltrations and atrophies, and in cases in which the bony walls of the nasal chambers are attacked either by osteitis or by necrosis. He reports twenty-three cases in which the lachrymal duct was obstructed, with coincident chronic nasal catarrh. One of these patients had an offensive discharge from the right nostril, and obstruction of the lachrymal duct of the same side. The patient declared that the discharge from the lachrymal sac often had an offensive odor,—the odor, indeed, of the nasal discharge itself. It was never purulent, however, and exhibited the appearance usual in lachrymal disease.

Schmidt-Rimpler,³ Stellwag von Carion,⁴ Schirmer,⁵ Masini,⁶ Clark,⁷

¹ Michel's Jahresbericht, 1885, S. 480.

² Philadelphia Medical News, February 6, 1886.

³ Augenheilkunde und Ophthalmoscopie, 1886.

⁴ Diseases of the Eye (English translation), p. 421.

⁵ Erkrankungen d. Thränenorgane, Graefe und Saemisch's Handbuch, Bd. vii.

⁶ Bollettino di Oculistica, viii.

⁷ Columbus Medical Journal, vii., August, 1888.

Mackenzie,¹ De Schweinitz,² and many others have also discussed this relation.

Treatment of Lachrymal Obstruction.—There is considerable difference of opinion as to the proper method of treatment in cases of epiphora. Of course when the symptoms are due to evident eversion of the puncta, or failure in their normal apposition with the globe, the result of ectropion, blepharitis, conjunctivitis, or traumatism, this anomaly must be corrected. Sometimes the puncta are congenitally absent, or closed, sometimes occluded by foreign bodies, as a lash, chalky concretions, or polypi. It hardly needs present allusion to the fact that if there is any reason to suspect nasal disease, if there is a history of rhinitis or of intra-nasal operations, etc., the primary indications are for a thorough examination of the nares and naso-pharynx, with a view of ascertaining if the intra-nasal orifice of the duct is patent, if diseased secretions are being transferred by the duct to the sac, etc., or if diseased processes are extended by continuity of tissue from the nose to the drainage-mechanism of the eye. Exception must also be made of reflex lachrymation, the primary source of the irritation being in the nose or elsewhere, and the phenomenon being due to hypersecretion rather than to subnormal excretory function. Even when the intra-nasal disease may be the primary point of departure of the morbid processes culminating in stenosis or occlusion of the lachrymo-nasal canal, it will often be found that treatment of the nasal conditions alone, without the supplement of treatment from the ocular end of the system, will not entirely or speedily cure the dacryocystic or conjunctival sequelæ. In pathology the effect does not always cease with disappearance of the cause. Chronic congestion has set up chronic organic changes, the lumen of the canal has been narrowed or closed by the results of inflammation, fibroid adhesions or proliferations, etc. Then, too, it is frequently impossible to tell in the beginning what changes have taken place, how far the symptoms are due to functional causes alone, or how far they are organic.

It may be admitted that generally the ophthalmic surgeon proceeds at once to radical and operative methods when a patient presents with dacryocystitis. I have contended³ that in all cases a tentative or palliative treatment should be instituted before destroying the physiological function of the puncta (with their sphincter fibres), and especially before jamming a rigid rod of metal down into the inflamed or at least narrowed canal, with its delicate lining of mucous membrane, and thus crushing the latter between the metal and the bony walls of the duct. I have been moved to emphasize this preliminary treatment by the success attending a little manipulative device consisting in the following procedure. The retained secretions of the sac having been emptied by pressure, and the eye cleansed of the same, let the patient lie down, or cant his head backward and to one

¹ Diseases of the Throat and Nose, p. 313.

² Transactions of the Philadelphia County Medical Society, 1892.

³ New York Medical Journal.

side, so that the inner canthus of the affected eye shall form the bottom of a depression that will hold an antiseptic and astringent solution. The proportions of the solution I use are as follows :

R Acidi borici, gr. x ;
Sodii chloridi, gr. iii ;
Zinci chloridi, gr. i ;
Aquæ destillatæ, f℥i.

I have this made in large quantity, doubly filtered after long settling, and deeply tinted with blue pyoktanin.

With the inner canthus and the puncta submerged with this solution, I again empty the sac by pressure with the little finger from below and towards the eye, then slowly relaxing the pressure the resiliency of the walls of the canaliculi and sac will suck in the antiseptic solution and bring it in contact with the parts before filled with unhealthy secretions. Again pressure is made from the eye towards the duct, so as to drive the solution down into the duct. This little manipulation several times repeated at one sitting, and with two or three daily sittings, will, according to my experience, speedily cure a large number of cases. It has the excellent merits of avoiding surgical operations, and of being easily carried out by the patient or by his friends at home. In some cases it is inefficient, and when proved to be so I insert the sharp point of the iris scissors into the punctum and snip it open by a stroke perpendicularly downward towards the palpebral fold, one-sixteenth to one-eighth of an inch long. The opening into the canaliculus is thus enlarged, and a larger influx of the irrigation-solution is allowed to enter.

But when this or some other palliative method proves ineffectual, organic stricture is present, and it must be treated by surgical or radical measures. These, with their operative details, are given *in extenso* in every good book on diseases of the eye. My personal experience again leads me to advise conservatism. I should first try simple slitting of the canaliculus, and repeated irrigation, before probing the duct. The custom of ramming the canaliculus knife down into the duct seems to me in the beginning, if not always, simply barbarous. The same word I would also apply to the use of large probes and the act of driving them into the duct with any great force. Certainly only the smallest probes should be used at first, and the entrance effected more by the light *tactus eruditus* than by muscular force. The varying diameters of the bony canals, and the deflections from the normal either in direction or in straightness, prove anatomically the wisdom of caution. Fulton¹ reports a case of severe orbital cellulitis consequent upon the passage of a No. 4 Bowman's probe into the duct in suppurative disease of the sac, with a fistulous opening upon the cheek. Flushing and forced irrigation of the duct are sometimes, though rarely, I

¹ Archives of Ophthalmology, xiv., 1885.

think, advisable, by means of a delicate canula inserted at various depths, and by a syringe with a nozzle to fit into the canula.

OCULAR DISEASES OF INDIRECT NASAL ORIGIN AND DOUBTFUL METHOD OF TRANSMISSION.

There exist in medical literature, and every ophthalmologist has seen illustrative cases, many instances of functional troubles of the eye which were connected with nasal disease, but in which the exact method of intermediation was indeterminable. One case seems more certainly neurotic, another due more to vascular anomaly,—venous stasis or congestion passed by extension to the ocular system,—whilst in some cases both factors are at work. The practical doubt as to etiology is experienced in the present literary endeavor tentatively to classify and group all such diseases into some convenient order until, with more exact knowledge, they shall fall into their places with scientific accuracy and systematization.

I append résumés of some of the more noteworthy of such cases as have fallen under my observation :

Ziem¹ effected permanent cures of lachrymation, blepharospasm, persistent and recurring inflammations of the conjunctiva and cornea, etc., in a number of cases, by removing adenoid growths in the naso-pharynx, hypertrophied tonsils, etc., after the patient had resisted local treatment of the eyes for weeks. He believes that the relation existing between the diseases is not due to a reflex irritation, but to interference with the circulation in the cavernous plexuses of the nasal mucous membrane. The venous stases are brought about by deficient aspiration, and this is caused by neoplasms weighing down and interfering with the muscles of the palate and pharynx. Such stases, if they extend to the flexible elastic organ of the eye, the ciliary body, might explain the appearance of asthenopia in chronic tonsillitis. Lachrymation and its consequences he considers as sometimes due to deficient aspiration of the tears, which is one of the factors in their deflection, in the cases where adhesions exist in the region of the organs of the pharynx. He commends thorough examination of the entire naso-pharynx in all cases that, owing to their chronic and relapsing character, are generally considered of a scrofulous nature.

Ziem² also records a case of intense congestion of lid and eyeball due to complete obstruction of the nasal cavities by a tumor.

Gruening³ asks whether, if in a considerable number of cases showing in bold relief the ocular symptoms of lachrymation, photophobia, and increased vascularity, local and general treatment prove ineffective, whilst nasal treatment (anti-catarrhal) is effective, the *a posteriori* argument is not conclusive. A few illustrative cases are cited of the large number observed. Others are given where immense hypertrophic swelling of the corpora

¹ Augsburger Medicinische Centralzeitung, 1886, No. 20.

² Münchener Medicinische Wochenschrift, 1892.

³ New York Medical Record, January 30, 1886.

cavernosa of the turbinated bones, stenosis, septum deviation, etc., are the origins of the ocular symptoms, consisting in the following: 1. Burning and smarting sensation of the lids, or of the eyes, most pronounced in the morning. 2. Inability to fix an object in ordinary daylight. 3. Increased vascularity of conjunctiva, and lachrymation upon slight provocation. 4. Sound condition of the eyes and their appendages. 5. Inefficiency of the ocular and general treatment. 6. Efficiency of the nasal treatment in spite of the absence of nasal symptoms.

Bettman¹ gives the details of six cases in which there were great lachrymation (but with pervious tear-passages), photophobia, blepharospasm, asthenopia, all depending upon intra-nasal disease, especially upon swollen turbinated bones, etc.

In a private letter Dr. James Wallace, of Philadelphia, traces congestion of the retina and choroid, and inability to maintain the visual function for any considerable time, to stagnation in the veins of the nasal mucous membrane.

E. Berger² describes a case believed by him to be unique, where the application of the galvano-cautery to the nasal passages produced a decided amblyopia. The subsequent spontaneous recovery was gradual. Dr. Ziem³ presents three similar cases of ocular troubles. In the first case cauterization of the hypertrophied mucous membrane of the middle turbinated bone of the right side was followed by indistinctness of sight of the right eye. Sph. +4.5 gave V. $\frac{20}{40}$ with the right eye; sph. +4.00, V. $\frac{20}{60}$ of the left. There was pulsation of the veins of the right papilla; none in the left. There was also slight limitation of the right visual field as compared with that of the left. In the second case cauterization of a small tumor in the inner canthus of the left eye was followed by impaired vision and decided hyperæmia of the papilla of the left eye. In the third case cauterization of the nasal passage, followed by some hemorrhage, seemed to reduce the intra-ocular tension, and to produce pronounced venous pulsation and papillary hyperæmia.

Hamilton⁴ gives details of the following cases:

CASE I.—Empyema of the antrum and unilateral hypertrophic rhinitis of the left side, attended with eye-symptoms: 1, concentric contraction of the visual fields for all colors; 2, accommodative asthenopia; 3, retinal hyperæsthesia; 4, peculiar subjective sensations of light; 5, photophobia, with blepharospasm and infra-orbital neuralgia. The evacuation of the empyema and its cure were speedily followed by the disappearance of the eye-symptoms.

CASE II.—Echondrosis of the triangular cartilage and chronic rhinitis. This case was attended with the following eye-symptoms: 1, asthenopia;

¹ Journal of the American Medical Association, viii., 1887.

² Archiv für Augenheilkunde, xvii. 3.

³ Centralblatt für Praktische Augenheilkunde, May, 1887.

⁴ Transactions of the Intercollegiate Medical Congress of Australasia, 1889, ii. 779.

2, pain in the eyeball; 3, injection of the eyes when used for close work; 4, blepharospasm; 5, contraction of the visual fields. These symptoms disappeared on the removal of the growth.

CASE III.—Spine of the bony septum, causing chorea magna. The following eye-symptoms were present: 1, asthenopia; 2, subjective color-sensation; 3, sneezing; 4, contraction of the fields of vision. These symptoms disappeared on the removal of the spine.

CASE IV.—Advanced chronic atrophic rhinitis, with middle turbinate hyperplasia. The following eye-symptoms were present: 1, asthenopia; 2, lachrymation; 3, puffiness of the lower lid; 4, contraction of the visual fields. These symptoms were relieved by the treatment of the nasal condition.

CASE V.—Syphilitic ozaena. The following eye-symptoms were present: 1, asthenopia; 2, lachrymation; 3, pericorneal injection on using the eyes; 4, contraction of the fields of vision, which was temporarily removed by the use of amyl nitrite. These eye-symptoms ameliorated as the nose improved.

CASE VI.—Polypi, nasal and naso-pharyngeal, with eye-symptoms similar to those recorded.

Lennox Browne¹ reports a case of severe glaucoma with intense pain, and not improved by iridectomy. The pain disappeared and the sight gradually improved upon removal of polypi in both nostrils, and without further treatment of the eye-disease.

Clark² details a case in which chronic choroiditis, with marked deterioration of visual acuteness, seemed to some extent dependent upon abnormalism of the turbinated bone of one side.

Cheatham³ describes three cases of asthenopia accompanied by other ocular symptoms. In each instance the ciliary weakness was found dependent upon local nasal trouble, such as catarrh, polypi, obstruction from deflected nasal septum, engorged tissue, etc. Ocular relief and strength immediately followed upon cure of the nasal abnormality.

Clark⁴ describes a case of spasm of the accommodation relieved at once by the application of cocaine to the enlarged cavernous tissue over the turbinated bodies. He mentions a number of cases in which asthenopic symptoms were relieved in the same way.

Bates⁵ reports a number of cases in which the vision in myopia was improved by local nasal treatment, consisting in the removal of hypertrophies, relief of catarrh, etc.

Eales⁶ reports a number of cases of retinal hemorrhage associated with

¹ British Medical Journal, May 28, 1887.

² Columbus Medical Journal, vii., August, 1888.

³ American Practitioner and News, April 2, 1887.

⁴ Columbus Medical Journal, vii., August, 1888.

⁵ New York Medical Journal, April 18, 1891, and Virginia Medical Monthly, February, 1892.

⁶ Birmingham Medical Review, ix. 262.

epistaxis and constipation. Such are probably instances of associated symptoms due to a common cause.

With such cases as that of Quinlan,¹—convergent strabismus of ten years' standing cured by operation on deflected septum,—and that of Cline,²—severe blepharospasm dependent upon “an enlarged and boggy condition of the turbinate bodies,”—we pass to the class of cases caused by pure neurosis.

II.—PATHOLOGICAL CONDITIONS OF THE EYE SECONDARILY AFFECTING THE NOSE.

The chief reason for the extreme shortness of the section including these conditions as compared with that presenting the ocular diseases caused by nasal anomalies lies evident to hand. The eye, from its far greater delicacy and complexity of structure, is infinitely more subject to injurious influences from its inferior neighbor, and its function, relatively, is of such transcendent importance to the organism that nature has evolved a freedom from idiopathic disease, a self-healing and self-cleansing power, that make it a less troublesome companion. From its psychological nature and intimacy with cerebral functions, moreover, its reflexes naturally tend brainward. And yet instances of its pathological influence upon the nose are not wanting. I have had a number of cases in which ocular treatment influenced nasal conditions for good. One especially striking case I have reported³ in which, beyond doubt, the production of a severe “common cold” was repeatedly shown to be dependent upon ametropia. When I reported this case I had not heard of the paper of Miles,⁴ who contends that ocular irritation due to errors of refraction is a not infrequent cause of nasal affections. He says that

“Among ten hundred and sixty-four cases of functional nervous affections in which the influence of eye-strain was carefully investigated, and of which a large proportion were treated wholly or partially by neutralizing the ocular defect with suitable lenses, three hundred and fifteen were examined in regard to nasal affections. Of these, one hundred and seven cases were found to sneeze more frequently than usual; as, for instance, on going from the dark into the light, on going from the house into the sunshine, when glancing at the sun, a clear sky, or bright object, and often without apparent cause. Many were, or had been, much given also to nose-bleeding catarrh, and some to itching or tickling sensations in the nose. In nearly every such case examination revealed errors of refraction. That ocular irritation was a common cause of these disorders is probable from the fact that, upon correcting the ametropia with suitable lenses, the usual tendency to bleed, sneeze, etc., was often either entirely or in a great

¹ New York Medical Record, May 30, 1891.

² Cincinnati Lancet Clinic, January 23, 1892.

³ Medical News, March 12, 1892.

⁴ Weekly Medical Review, x., 1884.

degree removed, and especially when associated with asthenopia and headache." A number of illustrative cases are described in detail.

Free irrigation of the eye with collyria carried to the nose through the duct may exercise a beneficial influence there. I have had a number of cases, resembling light hay-fever, of spring catarrh, etc., in which local ocular treatment beyond question relieved associated nasal symptoms. Allusion in this connection may be made to Mackenzie's advice¹ to hay-fever patients to wear spectacles with frames tightly fitting the orbital borders, in order to keep out dust, pollen, etc. That excellent observer, Nieden,² advances the theory that the failure of the physiological excretion of tears has upon the nose an injurious effect. He says,—

"I cannot get rid of the impression that the chronic inflammation of the nasal mucous membrane in which a thin secretion, instead of flowing off, desiccates upon the surface in the shape of brown or greenish crusts of dried mucus, which easily decompose and originate the repulsive and characteristic odor [of ozæna], and are additionally accompanied with atrophy of the underlying turbinated bones, is considerably influenced by the absence of the constant though slight moistening of the nasal passages normally excited by every motion of the eyelids.

"Although it may be replied . . . that this part of the secretion can only represent a minimum, because by far the greatest portion of the constant outpour of the lachrymal gland is dried up within the conjunctival sac or upon the surface of the eyeball, yet even this minimum is quite sufficient to make its absence felt by any patient. Thus, almost every one who comes for advice in the early stage of a lachrymal affection . . . complains of his own accord of the simultaneous observation of the obstruction to the tears, and of a disagreeable sensation in one nostril, exhibiting itself in tickling, or irritation, or a distressing fulness or tension. . . .

"My opinion of the mutual relations of ozæna and epiphora is that, although a simple chronic inflammation of the Schneiderian membrane with its sequences at the nasal orifice of the lachrymal duct may be the original cause of the lachrymation, yet I think that the development of the chronic rhinitis into an ozæna is largely due to the absence of this regular lachrymal secretion, so that the mucous secretion sooner desiccates upon the nasal mucous membrane, then decomposes, and finally yields to fermentative alterations. This, too, seems to me the only way of explaining those cases, so obscure to the rhinologist, in which, despite every symptom of dry catarrh, no ozæna is excited, simply because there has never been any lachrymal affection to react upon the nasal mucous membrane."

There can be no doubt that it is sometimes true, as Lueddekens³ says, that abnormal redness of the nose is due to the pressure of spectacle-bridges upon the bridge of the nose.

¹ Diseases of the Throat and Nose, p. 310.

² Archiv für Augenheilkunde, xvi., 1885-86.

³ Ibid., 1891.

SKIN DISEASES OF THE NOSE.

BY L. DUNCAN BULKLEY, M.D.,

Professor of Dermatology and Syphilis, New York Post-Graduate Medical School and Hospital; Attending Physician to the New York Skin and Cancer Hospital, etc.,
New York City.

THE nose may become the seat of various affections of the skin, which may, in turn, involve to a greater or less degree the mucous membrane of the same.

It would be out of place to treat here very thoroughly of all the conditions which might possibly occur in this location, but we will briefly indicate the more common of them, and their nature and treatment. Those we shall consider are as follows:

Acne, eczema, epithelioma, erysipelas, erythema, leprosy, lupus, nævus, psoriasis, rhino-scleroma, rosacea, seborrhœa, sycosis, syphilis, telangiectasis, and the eruptions from iodide and bromide of potassium, etc.

In addition to these, we may, of course, have the lesions of various other affections occurring upon the nose in conjunction with their appearance elsewhere, but as these would be otherwise recognized than by their local development upon the nose, they need not be referred to. There is no need of attempting a classification of the few affections we are to consider in this location, but they may be roughly spoken of as belonging to "benign" and "malignant" affections: acne, eczema, erysipelas, erythema, nævus, rosacea, seborrhœa, and sycosis are benign and non-destructive in character, while epithelioma, leprosy, lupus, rhino-scleroma, and syphilis may, at times, seriously involve the integrity of the organ and produce great destruction.

For convenience, we will consider the diseases here referred to in alphabetical order.

ACNE.

The various affections of the sebaceous glands which are grouped under the term "acne" may be divided into two main classes: first, those due to faulty secretion or excretion of sebaceous matter, including comedo and the forms of seborrhœa; and, second, those exhibiting inflammation of the glands and surrounding tissue; to the latter belong acne simplex, acne indurata, and acne rosacea.

The functional derangements of the sebaceous glands on the nose are very common, and oftentimes exceedingly rebellious to treatment.

Three forms of disorder may be readily made out :

1. Comedo, which represents a sluggishness of the glands, whereby their contents, instead of being expelled, remain hardened in the follicle.

2. An oily seborrhœa, where the nose is continually bathed with a greasy secretion, which represents an altered and rather increased activity of the glands ; and—

3. A dry or crusty seborrhœa, where the secretion adheres on the surface in scales or crusts of a very greasy character and of greater or less thickness.

The condition of comedo may vary from the existence of a few large plugs, which may be readily squeezed out, to that of a very large number of fine black points, representing each a plugged follicle, from which but little material can be expressed ; these open follicles are found to be very shallow.

Acne simplex seldom comes upon the nose alone, but is more commonly seen upon other parts of the face as well. When affecting the nose it may manifest itself as a single pustule, inflammatory in character and tender to the touch, or there may be a number of small pustular lesions, each commonly having a comedo in its centre. Occasionally larger lesions of acne indurata will occur, and especially towards the end of the nose ; there may then be no distinct pustular point, but only an evenly rounded redness, which, however, on deep puncture will give exit to a small amount of pus.

Acne rosacea very frequently manifests itself first, or alone, upon the nose ; it is characterized by an even, more or less diffused, redness, with heat, manifested especially by flushings after eating and from change of temperature, and later with more or less inflammatory papules, and perhaps scaling. (See Rosacea.)

As a sequence of acne, especially of acne rosacea on the nose, we sometimes meet with a condition which is described as "*telangiectasis*," consisting of dilated and tortuous vessels of various sizes, which are seen to ramify over the surface, generally beginning at some well-defined point, whence they issue from below.

As a further sequence of acniform eruptions on the nose, we may have a greater or less hypertrophy of all the cutaneous structures, leading up to a condition to which the name *acne hypertrophica* or *rhinophyma* has been given. This hypertrophy may be of moderate extent, consisting simply of a general enlargement of the organ, more pronounced on its tip, or the increase of tissue may be so great as to form a mass the size of an egg or larger, which, indeed, may project over and has been known to cover the mouth. The surface of this hypertrophic growth is generally of a bluish color, rather cold to the touch, with open follicles from which may often be squeezed a creamy substance. It may be composed of an evenly solid mass or be quite lobulated.

Diagnosis.—There should not be much difficulty in diagnosing the

sebaceous diseases of the nose. The inflammatory forms of acne are always characterized by more or less pain and tenderness, but sometimes the differential diagnosis between this and some of the later forms of syphilis is rather difficult.

Etiology.—The causes of acne have to do with the system at large, and the eruption is always connected with debility and very commonly with functional disorders of the digestive organs, and for its cure very marked constitutional treatment is generally required. In a certain number of cases the skin affection is reflex in character, due to gastric or intestinal disorder, and sometimes it depends upon sexual derangement.

There have been suggestions made on several occasions that acne is connected with and dependent upon disease of the nasal cavity: while this has not been absolutely demonstrated, there is much reason to believe such to be the case occasionally.

Treatment.—The internal treatment of acne of the nose must be conducted upon broad medical principles, and cannot be entered upon here. There is no specific for the disease, nor any single remedy which exerts much power upon it, unless it be sulphide of calcium, in quarter-grain doses every two hours, in some of the pustular forms. Arsenic is of no real value in this complaint.

The local treatment of the different forms varies considerably with the condition present. In the more acute, inflammatory conditions, a soothing application is required, and a calamine and zinc lotion will often give the very best results. When the inflammation is not so great, a lotion composed of sulphuret of potassium and sulphate of zinc, one drachm of each, with four ounces of rose-water, forms a most excellent application. It should be applied several times a day, sopping it and allowing the sediment which forms in it to dry upon the surface. Another good lotion is formed of one drachm of sulphur, four drachms of ether, and three and a half ounces of alcohol.

The relief of the functional forms of acne on the nose is sometimes more difficult than is that of those of an inflammatory character. A persistent blocking up of the follicles will sometimes prove most rebellious to treatment, and will only yield finally to the most carefully regulated diet and mode of life and prolonged internal treatment. It is very easy to irritate the nose too much in the effort to remove this difficulty, and care should be taken not to employ too strong agents. A weak solution of resorcin and salicylic acid (two to four per cent.), with a little alcohol, will sometimes answer about the best for this and for the greasy condition which sometimes prevails on the nose.

ECZEMA.

Eczema does not commonly affect the nose alone, but occasionally it may be found existing only on this organ, either outside or within the nares. Erythematous eczema may, however, not infrequently exist for some time

in the angle between the nose and the cheek, extending up both sides a varying distance, and may persist here most rebelliously and be very annoying from the persistent itching. This form of eczema is often mistaken for erysipelas, and is frequently called "chronic erysipelas," which, however, is, of course, quite erroneous. Within the nares eczema will often exist either as a moist or a dry eruption, sometimes persisting for weeks, and giving rise to a great deal of annoyance, both from the crusting formed and from the annoying itching.

A slight degree of the same may also exist at the nares alone, forming fissures which will be painful and cause considerable discomfort.

Acute or subacute pustular eczema is also seen upon the upper lip, just below the nares, being frequently due to an irritating character of the secretion from the nose.

Diagnosis.—The diagnosis of eczema of the nose need not be difficult, although sometimes a mild infiltrating syphilide about the nares may strongly resemble an eczema.

As mentioned before, erythematous eczema is often mistaken for erysipelas, and the distinction between a very chronic acne rosacea and erythematous eczema is sometimes difficult to make out.

Etiology.—The causes of eczema on the nose are the same as those of the disease elsewhere; in a very large number of instances it is constitutional in origin, and connected with a gouty or rheumatic state, or with errors of assimilation.

Eczema about the orifice of the nose is very commonly connected with some form of indigestion, either primary or secondary. This is seen to be the case more particularly in children, and is also true in many cases of adults. In some cases of eczema in the nostril, however, the eruption is largely of local origin, due to irritating secretions from the nasal cavity, incident to colds, and is often kept up by picking off scabs already formed.

Treatment.—To be really successful, the treatment of eczema must embrace matters of diet and hygiene, together with internal medication, which cannot be entered into here, but which are well presented in the text-books.

The local treatment of eczema about the nose is generally simple, but will sometimes require some care, for it is very easy to keep up the disease indefinitely, either by bad treatment or by neglect; on the other hand, it is sometimes exceedingly difficult to remove the disease entirely, even by the most careful and well-directed measures. The applications to this part of the face should be of a soothing character, unless there are very strong indications to the contrary; when any stimulant is employed, it should be followed by sedative measures.

For acute eczema within the nostril and in the region of the upper lip, nothing is better than a camphor and calamine ointment (℞ spt. camph., fʒss; pulv. calamin. præp., ʒi; zinci oxidi, ʒss; ung. aquæ rosæ, ʒi). This should be carefully put within the nose by means of some small, solid object,

such as the end of a pen-holder or a glass rod, for it is not possible to apply it properly with the finger-tip. It should be applied deeply and thoroughly, perhaps nearly an inch into the nose, and carefully coated on all sides of the cavity. This is to be done morning and night, or sufficiently often to keep the part entirely protected with the ointment. Care must be taken not to irritate the nose by blowing it forcibly or by picking off the scabs, and the diseased surface should be wiped off gently when necessary and the ointment immediately reapplied, instead of being washed or the crusts removed forcibly.

For erythematous eczema on the nose and at the sides, a tannin ointment (3i ad 3i), with five to ten minims of carbolic acid, will often serve the best. When there is much of a greasy or oily element present, a lotion of resorcin, three to five per cent., with a trifle of glycerin and alcohol, followed by a mild ointment, serves to check the eruption. When there is much thickening at the sides of the nose or nostrils, a tarry preparation will be required. This should be mild, such as the oil of cade (f3i ad f3i) in the calamine ointment previously mentioned, or the unguentum picis, three times diluted, serves a good purpose. But all applications to the nose should be mild and non-irritating, except under the rarest circumstances.

Prognosis.—Although apt to be chronic and rebellious, eczema about the nose is curable with suitable and proper treatment of all kinds. But the erythematous form at the sides of the nose and cheek is sometimes exceedingly rebellious and apt to return with each cold season unless removed by treatment.

EPITHELIOMA.

It would be impossible in the short space allowed to give a full description of the clinical appearance, course, or treatment of epithelioma upon the nose, but a brief mention may aid in avoiding difficulties.

Epithelioma may appear and remain for a long time as quite an insignificant affair, giving rise to little annoyance, or it may develop very rapidly and proceed to the destruction of the entire organ and its surrounding tissues. In the latter case it is more commonly the result of unwise interference, for, if not irritated too greatly, it is rather the tendency of the disease in this location to remain quiescent, without much destructive action. In its early stages, epithelioma is characterized by a certain white or pearly character of its edge, with small elevations which are sharply defined and give a hard sensation to the finger. Sooner or later the centre of the little mass tends to break down and to become covered with a scale or crust; upon the forcible removal of this, very slight bleeding occurs, with subsequent progressive ulceration as the surface is further irritated by picking or otherwise.

Diagnosis.—Epithelioma of the nose is principally to be diagnosticated from lupus, rhino-scleroma, and syphilis.

Much confusion is often made by the failure to recognize the difference between true epithelioma, characterized by a proliferation of the epithelial

element of the skin, and lupus, which is due to a new formation of small round cells in the deeper layers of the same. But it is essential to determine the difference, in regard both to the matter of therapeutics and to that of prognosis. Lupus is always characterized early in its history by more or less of soft, pulpy tissue, brownish-red, and covered with a lightly adherent scale, beneath which the surface is red and shiny; when it ulcerates, the tissue is still soft, and different from the harder mass observed in epithelioma; lupus has never the pearly, hard papules or tubercles around its margin, characteristic of the latter disease.

From rhino-scleroma, epithelioma is sometimes very difficult to differentiate; but, on the other hand, the former disease is so exceedingly rare that practically it is not to be considered. It is characterized by a greater general diffusion and hardness of the entire tissues affected, there is but very slight tendency to break down, and the tissue exhibits a very kindly action towards cauterization or operative interference, whereas epithelioma often exhibits quite the reverse.

The diagnosis between epithelioma and syphilis of the nose is most important. The latter never presents the pearly tubercles already referred to, but is always characterized by more or less solid and inflammatory infiltration of a darkish red, with a ready tendency to ulceration and to the production of inflammatory crusts.

Treatment.—It is well to remember, in connection with the treatment, the old name which was applied to epithelioma about the face,—namely, *noli me tangere*,—for, if not actively and radically treated, it should not be touched. Superficial cauterizations, as with nitrate of silver, etc., are worse than useless, and are, indeed, positively harmful, only exciting new growth, and should never be applied. The treatment should be either very radical or very conservative. In elderly people, epithelioma often amounts to little or nothing if properly protected and cared for, and may last a very considerable length of time without doing any considerable damage. But almost any case of epithelioma can be readily lighted up into a progressive state, which may go on to great destruction.

For the milder treatment we can often accomplish something with ointments of pyrogallic and salicylic acid: of the former, two to five per cent., and of the latter, perhaps five to ten per cent. This ointment is objectionable on account of the blackening of the part, but if continually applied it will often be found to serve a most admirable purpose, and beneath it the disease will shrivel up and disappear.

More active treatment relates to the scraping with a curette, cauterization by heat or destructive agents, and surgical removal. If very thoroughly done, scraping will suffice to remove the disease when it is not too great. But in very many instances it is most difficult to practise this very thoroughly and to be certain that the entire disease is completely removed. After scraping thoroughly with a curette, the surface should be dried, the bleeding, if any, stopped by pressure, and the surface well dusted over

with powdered pyrogallie acid. The crust which forms is then to be left on until it falls off, a week or so later, when, if any of the disease remains, the process may be repeated. If this is perfectly done, a single good operation is often sufficient to remove a small lesion and restore health to the part.

Space will not permit a full consideration of the various caustic and surgical procedures relative to the disease in this locality, which are well considered in many of the text-books.

Prognosis.—The prognosis of epithelioma of the nose must always be guarded. For a while, in most instances, it appears to be a most benign matter, and may yield readily to treatment; in other cases it will return again and again, even after the most radical measures, and end in complete destruction of the part or in very great deformity.

ERYSIPELAS.

True erysipelas is seldom confined to the nose, but generally extends over more or less of the head, and may become a serious affection; it need not be especially considered here.

There is, however, a *pseudo-erysipelas* which, not infrequently, appears first upon one side or the other of the nose, and which may or may not involve the whole organ and extend upon the rest of the face. It is characterized by a moderate amount of heat, redness, and swelling, with some burning sensations, but never progresses either with the rapidity or with the severity exhibited by the true infectious erysipelas.

The eruption under consideration appears to be due to absorption of purulent material from the cavity of the nose, and, as far as can be learned, is a diffuse lymphangitis from this cause. It is seen mainly in those who are strumous and have catarrhal discharges from the nose. The eruption is very apt to recur, sometimes several times in a year, although there may be only single attacks at long intervals. It seems to be almost always due to some particular local irritation arising within the nasal cavity, picking off scabs, etc., which gives rise to the local infection. As far as can be learned, however, this condition is not further infectious, and new cases cannot arise from it, as in the case of true surgical erysipelas.

Diagnosis.—The diagnosis of this affection lies between true erysipelas, erythematous eczema, and erythema of the nose. It is less acute and severe than true erysipelas and more intense than erythematous eczema; it has none of the itching of the latter affection, and the slight febrile symptoms present generally serve to differentiate it from simple erythema of the nose.

Treatment.—The treatment is usually quite simple for each attack. It is often very difficult to prevent its return unless very thorough and persistent treatment is given to the cavity of the nose. It is well to give a sharp purge and some cooling diuretic mixture, followed by tonics and other measures suitable for restoring the general tone of the system after the attack. Locally, the calamine and zinc lotion, already referred to in other sections, is the most cooling and suitable application. In some cases, however, a

watery solution of ichthyol (five or six per cent.) will be more grateful, and in many instances the lead and opium wash will prove very agreeable.

Prognosis.—The prognosis of the individual attacks is good, as they seldom run any severe course, and, with attention to the cavity of the nose, their recurrence may be prevented.

ERYTHEMA.

The term “erythema” is used in dermatology both to describe a red-den state of the skin from many causes, and also to represent a definite disease; of this latter there are several varieties recognized, which, however, rarely affect the nose.

As a condition of the skin, erythema, or redness, is often seen upon the nose in conjunction with other maladies, but may also be observed alone without any other apparent connection. When there is simply redness of the nose, however, it is more commonly known as rosacea, and “erythema nasi” seldom appears in dermatological literature. When such a condition is seen, the nose is simply erythematous, of a moderate shade of red, the redness disappearing entirely upon pressure and returning almost instantly when the pressure is removed. This redness is often connected with an excessive oily secretion, giving the nose a shiny appearance, which recurs as often as the surface is cleansed. There is little or no swelling nor apparent heat with erythema nasi, nor are there any subjective symptoms of itching or pain.

Treatment.—The treatment of this mildly erythematous condition of the nose is often very difficult and not infrequently prolonged, even with the most careful and well-directed measures; there is almost always more or less gastric or intestinal disorder which requires rectification before much good can be done by local measures.

The local treatment of this condition consists mainly in cooling and very slightly stimulating applications, allowing any stimulation to subside after their use, that perfect reaction may occur.

The application of the ether and sulphur lotion mentioned in connection with acne is often valuable, as is also a resorcin lotion (three to four per cent. in water). Dusting powders containing salicylic acid and chalk are often serviceable in modifying the redness and helping to astringe the tissues. In some instances it appears that, as in acne, disease of the nasal cavity has something to do with the external redness, and this matter should always be looked into and rectified. The condition is always a rebellious one, and prognosis in regard to it should be guarded.

LEPROSY.

When well developed, the nose affected by leprosy presents so characteristic an appearance, being enlarged in all directions, with the nares gaping or, later, almost closed, that a mistake could hardly be possible after having once seen a picture of the same. The nose is generally affected

only after the disease has progressed for some length of time and has greatly involved the system, although occasionally there may be but few other signs to call attention to the disease than the enlarged nose. The surface of the nose affected with leprosy is apt to be irregularly raised in bosses of a rather darker color than the rest of the skin, and, later in the disease, ulcerations of varying degrees take place in this newly-formed tissue.

The diagnosis should not be difficult, but an infiltrating syphilide of this organ could resemble a leprous nose, and also possibly some forms of lupus might be mistaken for it.

LUPUS.

Two forms of lupus are to be differentiated in connection with the nose : the one characterized by a superficial process, leaving only slight scarring, *lupus erythematosus*, and the other associated with more or less destruction of tissue and subsequent cicatrization, *lupus vulgaris*.

Lupus erythematosus not infrequently attacks the nose first, appearing on one side or the other, or even on the tip, as a small, dark, reddened patch not very well defined, slightly raised above the surface, in which the most marked feature will be the prominent and enlarged follicles, filled with a rather hard, horny material. As the disease increases, the surface becomes more and more covered with a dry, horny scale, quite firmly adherent, which, when pulled off, will often be found connected with the hardened masses filling the gaping follicles ; when the scale is forcibly removed, the open follicles appear on the reddened base as holes made with a pin in a deeply reddened wax surface.

The disease is of slow progress, and a patch may sometimes remain for weeks without any apparent increase, or it may slowly spread from the nose until it involves a large portion of the face. More commonly, other single lesions appear elsewhere upon the face, upon the edge of the ears, and especially upon the scalp. When the patches of eruption are at their height, the surface affected is pretty sharply defined, slightly raised, and of a brownish-red or ham color. In the further progress of the disease there occurs atrophy of the sebaceous glands and general tissue, leaving a moderately depressed scar. The destruction in *lupus erythematosus*, however, is never marked, and the disease never erodes deeply and seldom causes very great disfigurement.

Lupus vulgaris is a rather rare disease in this country, the former variety being at least four times as frequent. It may begin upon the nose, although more commonly it appears first elsewhere. Its earliest lesions are characterized by small, rather pulpy masses deeply set in the skin, of brownish-red color, presenting but little elevation. The surface becomes covered with a thin, horny scale, but never presents the gaping follicles referred to in the description of *lupus erythematosus* ; the little tubercle forming the primary lesion of lupus, a solid, jelly-like mass, takes the

place of the normal structures of the skin, and as the disease increases, new masses are formed in the contiguous parts or elsewhere, which, coalescing, may form areas of some size. These may remain indolent, being simply covered with a horny, slightly adherent scale, or they may ulcerate. In severe cases all the tissues of the nose become wholly involved by the lupous process, and may be destroyed to any extent and be replaced by cicatricial tissue, which contracts and produces great disfigurement. In its worst condition, the portion affected by lupus becomes covered by crusted masses, quite firmly adherent, which, when forcibly removed, leave an ulcerated and bleeding surface, which soon becomes again crusted, and the ulceration progresses beneath it.

Lupus vulgaris tends also to attack the mucous membranes, and is likewise commonly found within the nose, as also in the gums and soft tissues of the mouth when there is much of the diseased process outside. Lupus vulgaris, if not disturbed by treatment, is exceedingly slow in its course, and may take years to involve any large portion of tissue.

Diagnosis.—The diagnosis of lupus vulgaris upon the nose is sometimes not a little difficult, but there are only one or two affections from which it is practically necessary to distinguish it. These are epithelioma and syphilis. From epithelioma it should be readily distinguished in the early stages, inasmuch as the tubercles or masses of the former are of a white, pearly character and rather hard, whereas those of lupus are always of a darker color, pulpy, and with a slightly adherent, papery scale. Later in the disease, when ulceration has set in, there is generally a hard margin associated with epithelioma, which is absent from lupus. There is also a greater tendency to bleed in the former. Finally, epithelioma is a very much more rapidly progressing disease than lupus, doing in months what the latter will often require years to accomplish.

Between tubercular and gummy syphilis of the nose and lupus the differentiation is sometimes very difficult, although, commonly, the past history of the case or the presence of other phenomena will be sufficient to establish the diagnosis of syphilis. In occasional instances, however, when these are absent, and when the nose alone is attacked, the lesions of syphilis may readily be mistaken for lupus vulgaris. As points of differentiation, however, may be named the greater pain in the syphilitic lesions, while lupus is almost painless, and the more rapid progress of specific lesions in contradistinction to the exceedingly sluggish character of the lupus formations. The ulceration of syphilis is apt to be much more rapid, much more striking, and is often very painful: true lupus is seldom a very greatly ulcerative affection.

Treatment.—The treatment of *lupus vulgaris* is largely local, as constitutional remedies have but little effect upon the disease. Attention should, however, first be paid to the hygiene, diet, and general life of the patient, for upon the excellency of these depends much of the reparative power of the system.

Local agents which exert a destructive influence upon the diseased masses are those to which we must look for relief of the complaint, and these may be roughly divided into mechanical and chemical.

In some instances true lupus can be excised with advantage, but this is very rarely the case; the disease is apt to come back either in the immediate surrounding tissue or not far distant. Thorough scraping with a sharp curette, and boring out the diseased parts by means of dental burrs or other instruments, will sometimes be efficient. The plan of multiple scarification which was praised some time ago finds few, if any, advocates now.

The actual or galvanic cautery is not very suitable for lupus vulgaris, unless it be used in the way of a fine point, attacking each individual nodule by penetrating to its base.

Mild measures, in the form of more or less destructive chemical agents, may often be employed with the greatest advantage. Prominent among these is salicylic acid, which, when used in a strong ointment, even up to twenty-five or fifty per cent., will alter the new growth, and, destroying it, allow healthy tissue to take its place. Such strong applications have, of course, to be alternated with mild ones, to allow the growth of healthy tissue to occur. The red iodide of mercury (gr. x-xxx : 3i) also forms a good destructive agent.

After many years of trial of different remedies and procedures, it is found, after all, that that recommended and practised by the elder Hebra, twenty or more years ago, will often yield the most satisfactory results. This consists in the deep boring out of the entire lupus tissue by means of sharp sticks of pure nitrate of silver, each nodule being pursued to the bottom, and the whole mass freely destroyed by means of the sharp point. Absorbent cotton or lint is to be packed on the bleeding surface, and in this manner large crusts will be formed of the destroyed tissue and coagulated blood, which are left on as a dressing for some days, or even a week or so, when the process may be repeated with greater or less severity. If the tubercles are thus attacked, each as they appear, and the disease is thoroughly treated with a nitrate of silver point, a healthy cicatrization will ensue.

The treatment of *lupus erythematosus* is of a very different character. Here the tissues are not infiltrated by a mass of succulent cells, but there is simply inflammatory exudation about the blood-vessels and sebaceous glands, with but slight new cell formation in their neighborhood; this cannot be destroyed by a stick of caustic, nor is it ordinarily touched by such measures as have been mentioned, nor, indeed, are they necessary. Oftentimes, only the most cooling applications will be suitable in this disease, and with proper internal care will be sufficient to remove it.

When there is much congestion or heat, the calamine and zinc lotion, already referred to under eczema, will be of much service, sopped freely on and left on the part continually; or the sulphuret of potassium and zinc

lotion, mentioned under acne, will, in rather more chronic conditions of the surface, prove available. A milder salicylic ointment (three to five per cent.), with zinc, will also be of value. Painting the surface with pure carbolic acid occasionally, allowing a slight crust to form and scale off, is often very serviceable.

Prognosis.—Unfortunately, the prognosis of both lupus vulgaris and lupus erythematosus is rather unsatisfactory. Lupus vulgaris is almost always a very tedious and rebellious disease, and will invariably be followed by more or less scarring.

Lupus erythematosus will more frequently yield to careful treatment, but will also be apt to be very rebellious; if much is done to it locally, and if the process has lasted a great length of time, there will pretty certainly be scarring resulting therefrom.

NÆVUS.

Nævus of the nose presents no distinctive features different from those exhibited in other parts of the body, and the condition is not very common on the nose alone. It may present any of its forms, and be deep or superficial. The treatment here is surgical, and need hardly be entered upon. The cautery treatment here, as elsewhere, gives about the best results, but it is almost always attended, as must be the case with all radical measures, by more or less of a scar.

With the introduction and success of the Thiersch method of skin-grafting, the disease can often be removed by excision and the graft employed, which will furnish the very best results attainable.

PSORIASIS.

Psoriasis may be said never to attack the nose unless it appears elsewhere, but it may, under certain conditions, involve the whole face to a very great extent, and occasionally the nose will be very much affected. Here, however, it always presents the ordinary phenomena seen on other portions of the body,—namely, separate and quite well defined patches of reddened surface, with a scaling which is more or less pearly; but on the nose the scales are always rather greasy, owing to the very great abundance of fat glands there present. It is mainly to be distinguished from scaly syphilide, eczema, and seborrhœa.

There is little to be said in regard to the treatment, all of which should be upon the principles indicated in psoriasis in general. For a local application upon the nose, nothing is better than the white precipitate and bismuth ointment (acidi carbolici, gr. v; bismuthi subnit., ʒi; ung. hydrarg. ammon., ʒii; ung. aquæ rosæ, ʒvi). If the eruption proves rebellious, a little aristol (fifteen to twenty grains) may be added.

RHINO-SCLEROMA.

Rhino-scleroma is an exceedingly rare disease, in regard to the true character of which we are still somewhat uncertain. It was first described by Hebra and Kaposi twenty years ago. There are hardly twenty cases known to have been reported anywhere.

Diagnosis.—Rhino-scleroma is characterized by a very hard, almost ivory-like appearance of the affected part: the surface is smooth, shiny, and may be of the normal color, though more commonly of a brownish red, with dilated blood-vessels over its surface. When well pronounced, the gland-orifices and the lanugo hairs have disappeared from the surface, the epidermis is tense, easily cracks, and from the cracks there may exude a viscid secretion, drying into rigid and adherent crusts. In its early stages it is hardly recognizable, the change which takes place is so slight; but when well marked the peculiar eburnated condition of the whole organ is very characteristic. The interior of the nose becomes thickened, and there may be absorption of the septum nasi from pressure. The disease has been reported as occurring upon the vocal cords, soft and hard palate, and pharynx.

Rhino-scleroma is to be differentiated principally from epithelioma, keloid, and the gummy syphilide, and the distinction is sometimes very difficult to make; but the stony hardness, very slow, painless growth, and its kindly character—*i.e.*, not tending to break down and ulcerate, even under irritation—distinguish it from all other complaints.

Treatment.—Very little can be said of treatment, because the results of all the cases heretofore treated have been very unsatisfactory. When excised, it very commonly recurs, and any destructive agent will produce only temporary benefit. Treatment must, therefore, be largely confined to symptomatic and palliative relief of the conditions present.

ROSACEA.

The term rosacea is used to indicate a certain amount of redness of the nose and central region of the face mainly, unaccompanied by any very active sebaceous lesions. Many writers make no distinction between rosacea and acne rosacea, but recent observers have endeavored to establish the former as a congestive affection, generally chronic in character, quite unconnected with sebaceous disturbances, and induced by reflex causes.

In its least pronounced forms it consists in a purplish redness of an irregularly-defined area, which redness disappears on pressure and quickly returns when pressure is removed. The skin is smooth and generally shiny, and may feel hot to the touch, although quite as often the surface is cool. The condition is subject to the greatest variations from the least excitement, or from the effects of heat and cold, stimulants, etc. In its more pronounced forms the redness may cover a large area and cause very considerable disfigurement. When the redness has long existed and has resulted in dilated

blood-vessels, which either ramify over the surface in very fine branches or are manifest as larger veins, the designation *telangiectasis* is applied.

Diagnosis.—The diagnosis of rosacea should never be difficult, although the differentiation between it and acne rosacea is sometimes puzzling. The condition is often spoken of, falsely, as *chronic erysipelas*, and is also sometimes known as *chronic erythema* of the nose. But the term “rosacea” has been pretty widely accepted to designate the condition above described.

From acne rosacea, if there is any difference, it is diagnosticated by the absence of inflammatory lesions, papules, pustules, and tubercles; sometimes a diffused, infiltrating syphilide might resemble it, but should be readily differentiated.

Treatment.—The treatment of rosacea should be both internal and external, for in the majority of instances it is a reflex symptom, representing some disturbance of other and distant organs. It is well, in conjunction with this, to remember the remark of Plenck, made many years ago, “*Nasus sæpe rubet a suppressis hæmorrhoidibus*,” for, although there may not be actually hemorrhoids in connection with redness of the nose, there is commonly some internal (liver or other) disturbance which must be reached in order to treat the case successfully.

It would be impossible here to enter at length into the principles of internal treatment, but a single suggestion may be thrown out with regard to the value of ichthyol, internally, in cases of trouble of this kind upon the nose. Given directly after meals, either in water or in capsules, in doses increasing from three to ten drops, it will be found to have a very marked control over the redness. Externally, lotions must be mainly of a soothing character, although too mild applications seem to have almost no effect upon the condition. Astringents of various kinds are applicable, one of the best of these being a sulphur and ether lotion (℞ Sulph. præcip., ʒi; ether. sulph., fʒiv; spir. vini rectificat., fʒiiss). An ergot ointment (ʒi to ʒii ad ʒj) will also sometimes seem to shrink up the tissues and diminish the redness.

In certain instances benefit will be received from surgical treatment in the way of the minute multiple incisions suggested by Squire, and also later by Besnier and Vidal, or the multiple puncture with a small lancet, allowing the nose to bleed freely, and then pressing cotton upon it, allowing it to dry down, with the hope that the severed blood-vessels will not unite perfectly. But this operation is unsatisfactory, and even when carefully performed is not as successful as one could hope. Where there are single large blood-vessels of some size ramifying over the surface, these can be easily destroyed and very much benefit produced thereby; this is accomplished either by slitting them up with a fine knife and then burning the track with a point of nitrate of silver, which will certainly obliterate each vessel, or by burning the vessels in their course by means of a fine point of an electro- or Paquelin cautery, or they can be destroyed by electrolysis, by introducing a needle into the blood-vessel.

SEBORRHŒA.

This condition has already been considered under the subject "acne," as representing functional disturbance of the sebaceous glands.

SYCOSIS.

Sycosis is ordinarily spoken of as associated with the hair of the beard, but the non-parasitic disease, indicated by this name, may appear on any portion of the body where there are hairs, and is occasionally seen in connection with the vibrissæ of the nostrils. It appears as an inflammatory affection, composed of single isolated points or pustules surrounding a hair, which are very sensitive to the touch. When the hair is extracted, the root will be found covered with a mass of succulent tissue, which is often supposed to be a sign of the presence of a parasite, but this is nothing but the products of inflammation in the infiltrated root-sheaths of the hair.

Sycosis of the nostril need not be confounded with any other affection; the occurrence of single, isolated, inflamed points, and the acuteness of the affection, with tenderness, are quite sufficient for the diagnosis.

The eruption is apt to be rebellious unless properly treated with constitutional means, for it has to do largely with a lowered vitality and a general catarrhal state of the system. Like eczema about the orifice of the nose, it sometimes depends upon a catarrhal discharge from above, irritating the parts, and may be best remedied by deep treatment to the nasal cavity. The treatment throughout to the skin-disease around the orifice of the nose should be soothing, no irritating or harsh measures being employed. A mild astringent of zinc and tannin, with a trifle of carbolic acid, will generally suffice to give relief, if early applied.

In making applications to the anterior nares it is often necessary to give the patient some instruction in regard to the mode of procedure. It does not suffice simply to apply it with the end of the finger, for it will be found impossible both to reach deeply enough and to leave sufficient coating of the ointment upon the sides. It is well, therefore, to demonstrate the method with a small pen-holder, or, better yet, with a small glass rod, making the applications in the manner mentioned under eczema of the nostril. To treat successfully the inflamed conditions at the orifice of the nose, these applications should be made quite deep, even half to three-quarters of an inch, the surface being coated in every direction with the ointment.

SYPHILIS.

This is, in all respects, the most important disease to recognize upon the nose, and one about which there will be often a very considerable amount of doubt; but upon the early, swift, and proper treatment of this disease, when present, the integrity of the organ will often wholly depend. This refers, of course, more especially to the later manifestations of the disease, so often accompanied by wholesale destruction of the organ.

Syphilis is seen upon the nose during all its stages, even from the primary lesion to its latest gummy manifestations many years after the entrance of the poison into the system.

Although chancres of the nose are relatively infrequent, the primary lesion of syphilis has been observed often enough upon this organ to warn one of the possibility of such a lesion occurring at all times. Chancres have been more commonly observed around the orifice of the nares, and just within the same, than upon the outside surface, although there is no portion of the outer integument that has not been seen to be the seat of such a lesion. The sore is usually of some size, up to half an inch or more in diameter, of a decidedly inflammatory character, raised above the surface, giving a sharply-defined margin, and commonly presenting great hardness. The surface, when not covered with dried crust, is of a purplish-red color, giving off a glairy, sticky secretion moderate in amount. There will generally be an enlargement of the pre-auricular glands, with, of course, general skin and other symptoms following in due course of time.

Chancres on the nose often persist for some time before they are recognized; but, however bad they may appear, and whatever disfigurement they may produce, the process is entirely removed by the treatment, and but a very insignificant scarring results.

The earlier, general eruptions of syphilis—erythematous, papular, and pustular—appear upon the nose only in conjunction with eruptions of the same character elsewhere, and need not detain us here. The tubercular eruption occurring late in the disease, from two years onward, and the gummy lesions of later date, are particularly important to recognize, as they frequently resemble and are confounded with other affections.

The tubercular syphilide may appear in many forms, covering the whole or part of the nose, and may be confined to this location alone, even with very little history of eruption elsewhere. The lesions may appear in the form of more or less ringed eruptions or single isolated papules or tubercles, which, however, are generally arranged in crescentic or annular shape. They are always but moderately raised above the surface, of a dark, brownish-purple color, with a considerable adherent scale or crust. In the non-ulcerative forms the eruption may last for weeks or months, without very much change, except a slow increase of the surface covered, but in the more severe ulcerative forms the tubercular syphilide may produce immense and rapid destruction on the nose and in its vicinity. This is, however, more commonly the case in broken-down and alcoholic subjects or in those in whom there has been an irritating and excessive local treatment. The tubercular syphilide is not confined to the exterior of the nose, but may pass within the nares, even to some distance, half an inch or more. The orifice of the nares will then be made large, gaping, and round, and more or less hardened. The interior surface will be crusted, and on the removal of crusts blood will follow, with a continued production of new crusts by the dried secretion from the surface. When this condition lasts some time, destruction of

the septum will easily take place, with perforation, which is by no means an infrequent occurrence. A longer duration of the disease involves also the bones, so that portions of them may necrose from time to time and be thrown out, producing great disfigurement in the organ.

The gummy syphilide is the one which is productive of the greatest destruction, and the one which often requires the greatest care in recognition and management. This usually affects the end of the nose, either on one side or the other, and presents itself as an indefinite enlargement or infiltration of the tissues, with more or less heat and redness, and often with very considerable pain. At times, one side of the nose only will be infiltrated, or, again, the entire free end of the organ may be involved in a mass of new tissue, which will tend to ulcerate in one place or another and have formed upon it crusts of varying sizes. When neglected or imperfectly treated, it tends to break down and produce ulceration, with loss of tissue, which may result in very considerable disfigurement of the nose.

Diagnosis.—Chancre on the nose may be mistaken for epithelioma. The tubercular syphilide is most commonly confounded with lupus, and the gummy syphilide simulates lupus, epithelioma, sarcoma, or rhinoscleroma. The relatively rapid development of the chancre suffices to differentiate it from epithelioma, together with the acuteness of the symptoms, the greater or less pain, the swollen glands, and the subsequent appearance of constitutional symptoms; these together are quite sufficient to distinguish the primary lesion of syphilis. The differentiation between the tubercular syphilide and some forms of lupus is often very difficult; but it may be stated that the latter is much more slow of development, is less apt to ulcerate and break down, occurs in much younger subjects, and, moreover, is relatively very uncommon in this country; indeed, lupus is very rare when compared with syphilis of this organ.

The same remarks apply, to a greater or less extent, to the gummy syphilide.

Treatment.—The treatment of syphilis of the nose must depend almost wholly upon internal measures, as local treatment plays a very unimportant part, and, of itself, is wholly unequal to the task of removing the disease.

This is not the place to enter fully into the matter of the internal treatment of syphilis, and it is only necessary to state that that instituted should be prompt, vigorous, and effective. During the earliest stages, as when there is a chancre or early manifestation of the disease, mercury in the form of tablets of mercury and chalk, one grain each, may be given every two hours, up to tolerance; or other measures, such as inunction, mercurial baths, hypodermic injections of mercury, mercurial solutions, etc., then may have their place, and, at times, be of service.

In the later stages of syphilis it is necessary, for the removal of the lesions, to use iodide of potassium in addition, and generally a mild mixed treatment of mercury and iodide of potassium, in connection with iron and bark, will prove most serviceable. When there is a large amount of infil-

tration or new formation, as in the ulcerating tubercular and gummy syphilides, it will be necessary to push the administration of iodide of potassium much more strongly, and it may then be given separately in a saturated solution (fifteen to thirty drops or more in Vichy water) an hour or so before each meal. It must be remembered, however, that the preparations of iodine are themselves very apt to produce nasal difficulties, and may, for the time being, seem to increase the discharge occurring in connection with ulcerative lesions about the nose.

In the vast majority of cases but little local treatment is needed, other than a mild protective covering of zinc ointment, with a small quantity of carbolic or boric acid in it. The great principle to be remembered is, that too irritating, caustic applications will tend to increase the trouble, whereas mild protective coverings, with sufficient and proper internal treatment, will almost invariably yield rapid and satisfactory results.

It is the practice of many to use local applications of mercurials upon the local lesions of syphilis; but experience has shown that this is not necessary, and that in many instances a mild non-mercurial application, thoroughly protective, will serve the purpose better. It is also not necessary to greatly cleanse or disinfect the surface, although a certain amount of care should be exercised that pus is not held confined, to produce greater irritation.

In the case of syphilitic lesions of the interior of the nose, the application of any ointment should be made very deeply, as suggested in regard to the treatment of eczema and sycosis of the nares, by means of a small glass rod or other implement, which can be introduced easily and the interior surface of the nose coated thickly and evenly with the desired medication.

When syphilis has destroyed the bones within the nose, these may require removal by means of surgical interference, but in a considerable proportion of the cases it is well not to interfere too early, but, by a thorough constitutional treatment, so to arrest the disease that any necrosed portions will be separated by the natural processes before surgical manipulations are undertaken.

The ozæna accompanying syphilitic diseases of the nasal cavity can be readily treated by means of peroxide of hydrogen or a mild solution of permanganate of potassium injected or sprayed into the nose two or three times daily.

Prognosis.—The prognosis of syphilis varies greatly, according to the lesions present, their duration, and the consequent destruction of tissue. The primary sore will always leave some scar, but need not be disfiguring unless it has existed for some length of time and has been over-treated locally. The earlier macular and papular syphilides leave no trace, but the pustular and tubercular forms are almost sure to be followed by more or less scarring. The ulcerative tubercular and gummy syphilides may produce destruction in varying degrees, and are always followed by a

cicatrix, varying in intensity according to the degree of destruction caused. It is often surprising, however, how relatively little disfigurement may be produced by what had appeared to be a very destructive lesion.

The difference between the prognosis of lupus in this region and syphilis is so great that much care should be exercised in diagnosis, as upon that will be based entirely the expectation, both in regard to the duration of the trouble and the consequent injury done.

TELANGIECTASIS.

This condition, representing a dilated state of the capillaries of the skin, has already been referred to under "acne" and "rosacea."

ERUPTIONS FROM BROMIDE AND IODIDE OF POTASSIUM.

These are rather rare, and still more rarely are they manifested greatly upon the nose, but they should always be taken into consideration in making a diagnosis of lesions in this situation. The milder forms of eruption caused by the drugs are exhibited in the form of erythematous blotches or superficial pustules, but occasionally lesions of much deeper and more aggravated character are seen, which may appear very threatening. When severe and greatly developed, they exhibit a pulpy mass, circular in outline, sometimes raised very considerably above the surface, and either covered with a pultaceous exudation or with an ill-formed scab. They are generally painless, but may sometimes give rise to so much swelling about the nose as to cause great discomfort. Not infrequently lesions of this character are mistaken for those of syphilis, and the iodide of potassium will be given in increasing doses, only to the very great increase of the eruption.

The treatment of these lesions is simple, they disappearing spontaneously after the cessation of the use of the drug; but their disappearance may be hastened by the administration of arsenic, which will also frequently serve to check their development, if given in conjunction with iodide and bromide of potassium when either of these is required for some other reason. Locally, very little need be done for these lesions; a little calamine and zinc lotion, such as has been already mentioned, or a soothing zinc ointment, with a little carbolic acid in it, is generally all the local treatment that is required.

PART III.

Diseases of the Pharynx and Larynx.

ANATOMY AND PHYSIOLOGY OF THE PHARYNX AND LARYNX.

BY ALEXANDER W. MACCOY, M.D.,

Professor of Laryngology in the Philadelphia Polyclinic and College for Graduates in
Medicine; Fellow of the American Laryngological Association, etc.,
Philadelphia, Pennsylvania.

PART I.

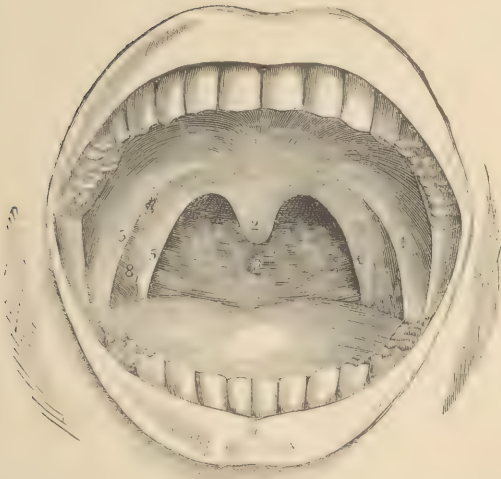
ANATOMY AND PHYSIOLOGY OF THE PHARYNX.

THE naso-pharynx having been already considered in the article on the anatomy and physiology of the nose and naso-pharynx, there remains for consideration only that portion of the tube known as the pharynx or lower pharynx. This part of the pharynx is often divided into two portions,—the oro-pharynx and the laryngo-pharynx,—these terms simply designating more specifically their situation and relations to other parts (Plate I., Fig. 1). The oro-pharynx extends from the base of the uvula downward to the level of the greater horn of the hyoid bone, and embraces that portion of the pharynx usually seen through the widely-opened mouth and commonly spoken of as the fauces. The opening from the mouth leading to the pharynx is known as the “isthmus of the fauces.” The boundaries of this isthmus are the free edge of the soft palate, including the uvula above, the pillars of the soft palate at the sides, and the upper surface of the tongue below. The relationship of the oro-pharynx to certain parts of the oral cavity is so intimate that it is the custom to treat of these structures as practically belonging to both. This leads to the consideration of the hard and the soft palate, uvula, palatine folds, and tonsils.

The *hard palate*, composed of the palatal processes of the superior maxillary bones anteriorly, and completed posteriorly by the palate bones,

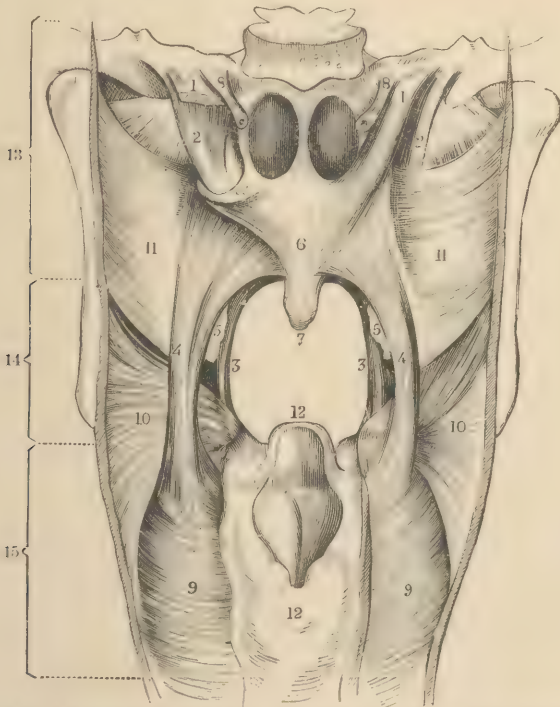
PLATE I.

FIG. 1.



ORO-PHARYNX AND SOFT PALATE.—1, soft palate; 2, uvula; 3 and 4, anterior pillars of the fauces; 5 and 6, posterior pillars of the fauces; 7 and 8, tonsils; 9, oro-pharynx. (Browne and Behnke.)

FIG. 2.



MUSCLES OF THE SOFT PALATE AND PHARYNX. PHARYNX LAID OPEN FROM BEHIND.—1, 1, levatores palati, the left being cut short near to its origin; 2, 2, tensores palati, the left showing its reflected tendon and relation to the hamular process (*a*); 3, 3, palato-glossi, anterior pillars of the fauces: 4, 4, palato-pharyngei, posterior pillars of the fauces; 5, 5, tonsils; 6, azygos uvulae; 7, uvula; 8, 8, Eustachian tubes; 9, 9, inferior constrictors; 10, 10, middle constrictors; 11, 11, superior constrictors; 12, 12, epiglottis and larynx, not laid open; 13, cephalo- or naso-pharynx; 14, hyo- or oro-pharynx; 15, laryngo-pharynx. (Gray and Browne.)

forms the roof of the mouth, and is limited by the alveolar processes at the sides and in front; behind, it is continuous with the soft palate. The bones constituting the hard palate are united in the median line and form a ridge terminating in front in a small papilla which corresponds to the orifice of the anterior palatine fossa.

The *soft palate* (*velum pendulum palati*) is a pendulous membranous curtain attached to the posterior border of the hard palate. This curtain assists to a certain extent in separating the oral cavity proper from the cavity of the pharynx. The lower portion of the soft palate hangs free, while the lateral portions blend with the sides of the pharynx and tongue by two distinct folds which separate as they descend, leaving a triangular space between them. These two lateral folds of the soft palate are named the anterior and posterior palatine folds or pillars, and are also spoken of as the anterior and posterior half-arches. In the median line of the soft palate is found a similar raphé, which also indicates the line of junction of the two halves of the soft palate. At the termination posteriorly of this ridge is a conical prolongation of soft tissue, known as the uvula, which hangs much below the free edge of the half-arches. The tissue composing the soft palate consists of aponeurotic tissue and layers of muscular fibres, glands, and vessels (Plate I., Fig. 2). The *muscles of the soft palate* are the levatores palati, tensores palati, palato-glossi, palato-pharyngei, and azygos uvulæ. The levators and tensors of the palate have already been considered in the pages devoted to the naso-pharynx.

The *azygos uvulæ*, now considered as two separate muscles, is composed of round, narrow bundles which arise from the posterior nasal spine of the hard palate and from the posterior portion of the aponeurotic layer of the soft palate, passes downward, and is inserted into the free end of the uvula. The function of this muscle is to shorten the uvula and draw it backward. The *palato-glossi* go to make up the body of the anterior palatine folds or anterior pillars of the fauces. The *palato-glossi* arise from the aponeurosis of the palate above, and are inserted into the sides of the tongue. These muscles act as constrictors of the isthmus of the fauces. The *palato-pharyngei* form the posterior palatine folds or posterior palatine pillars of the fauces. These muscles arise also from the aponeurotic layer of the soft palate and interlace with each other at their origin. The fibres of these muscles pass above and below the levator palati and azygos muscles, after which the fibres go to make up the posterior pillars or folds of the fauces. The insertion of the palato-pharyngei muscles is distributed to three distinct parts: the internal fibres go to the aponeurotic tissue of the pharynx in its centre, the middle fibres are lost in the soft palate, and the external fibres pass forward and are inserted into the thyroid cartilage on its posterior border. These muscles likewise contract the isthmus of the fauces, and, in unison with the levatores palati, aid in placing and maintaining the soft palate in a horizontal position.

The *plica salpingo-pharyngea* is a slightly projecting fold of mucous

membrane which extends from the posterior lip of the Eustachian orifice downward until it is lost in the parts below. This fold really belongs to the lateral wall of the naso-pharynx. In many instances, however, it can be seen extending down into the oro-pharynx. This fold is made more prominent by a free distribution of lymph-follicles which are found embedded in it.

The *tonsils (amygdalæ)*, situated in the triangular spaces between the anterior and posterior palatine folds, on a level with the angle of the lower jaw, and bounded in front by the tongue, are almond shaped bodies composed of lymphoid tissue bound together by fibrous tissue and firmly attached to the base of the triangular space between the pillars. The normal size is about three-quarters of an inch by one-half inch, the longer diameter being the vertical. The special anatomy of the tonsil as given by D. Bryson Delavan is as follows :

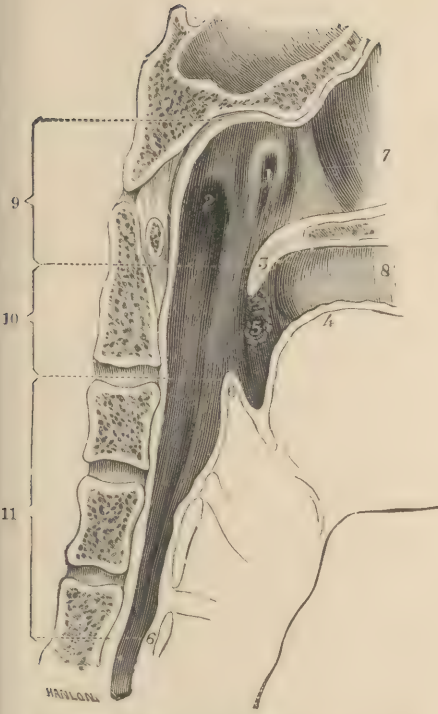
“The surface of the tonsil is perforated by varying numbers of slit-like and circular depressions,—the common orifices of the system of cavities which it contains. In man, this system of cavities may be considered as a multiplication of single lingual follicular glands to the number of from eight to eighteen, the interval between each gland forming a lacuna or crypt. There are also in the interior of the tonsil single layer cavities, each of which includes several follicular folds and procures their common discharge at the periphery. The crypts of largest size and greatest depth are filled more or less with a substance composed of fat molecules, loosened pavement epithelium, lymph corpuscles, small molecular granules, and cholesterin crystals.”

Observations of more recent date tend to show that the structure of the tonsil is a mass of lymphoid tissue presenting on its outer surface from five to ten orifices leading down into blind pouches or pockets. According to Retterer (quoted by Bosworth), the development of the tonsil in man consists in an involution of the epiblast into the hypoblast. From this single invagination, secondary invaginations occur into the surrounding tissue. As development progresses, the hypoblastic layer gradually grows in between these involutions of the epiblast, separating them one from another. The basement membrane of the epiblastic layer quite early during the process is lost, or so fused with the hypoblastic cells as to be indistinguishable. As development proceeds, the hypoblastic elements penetrate between the epiblastic involutions, separating them from each other, and also penetrate between the individual cells: gradually, portions of this hypoblastic tissue become condensed and give rise to the lobular structure of the tonsil,—this condensation or contraction taking place in the peripheral parts. As the developing tissue becomes more and more consolidated, epithelial cells become compressed to such an extent that they undergo a retrograde change or fatty degeneration, and finally disappear, leaving empty spaces which are termed the “lacunæ.”

It will be seen, then, that, except in early foetal life, the mass of the

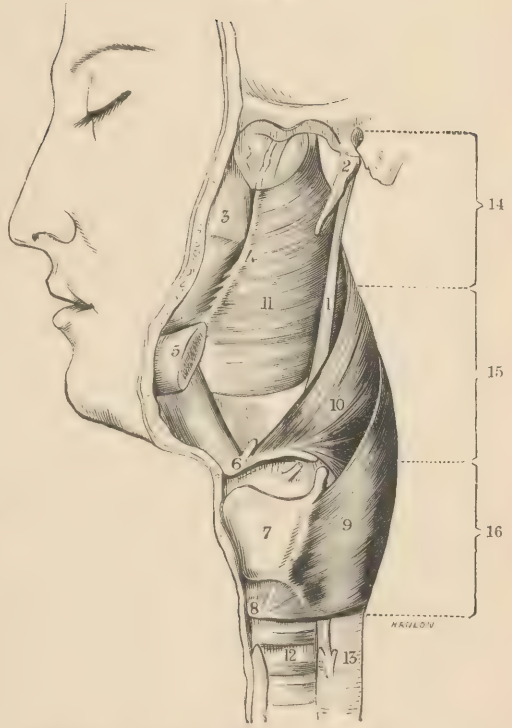
PLATE II.

FIG. 3.



SECTIONAL VIEW OF THE PHARYNX.—1, left Eustachian tube; 2, left fossa of Rosenmüller; 3, palate and uvula; 4, tongue; 5, left tonsil; 6, 6, upper and lower boundary of larynx, epiglottis, and cricoid cartilage; 7, cavity of the nares; 8, cavity of the mouth; 9, naso-pharynx; 10, oro-pharynx; 11, laryngo-pharynx. (Browne.)

FIG. 4.



SIDE VIEW OF MUSCLES OF THE PHARYNX.—1, stylopharyngeus; 2, styloid process; 3, upper jaw; 4, pterygo-maxillary ligament; 5, lower jaw; 6, hyoid bone; 7, thyroid cartilage; 8, cricoid cartilage; 9, left inferior constrictor; 10, left middle constrictor; 11, left superior constrictor; 12, trachea; 13, oesophagus; 14, naso-pharynx; 15, oro-pharynx; 16, laryngo-pharynx. (Gray and Browne.)

FIG. 5.



The hyoid bone, seen from above. (H. Allen.¹)

¹ "Allen's Human Anatomy," Lea Bros. & Co., Philadelphia.

tonsil is made up of hypoblastic tissue, consisting of cells, round, elongated, or stellated, and appearing under the microscope as simply lymphoid tissue. The lymphoid tissue, so markedly expressed in the faucial region, is but part of a chain of similar tissue which extends across the base of the tongue and lateral walls of the pharynx and naso-pharynx until the vault of the pharynx is reached, in which situation it is again expressed more fully in the tonsil of Luschka, or third tonsil. This chain of lymphoid tissue is sometimes spoken of as the "lymphoid ring." Externally, the tonsils are in relation with the superior constrictor muscles of the pharynx, outside of which are the external and internal carotid arteries, the internal jugular vein, and the glosso-pharyngeal and the pneumogastric nerves.

"The relations of the tonsil to the internal carotid artery" (as given by Delavan) "are not so intimate as commonly supposed, for between the lateral wall of the pharynx, the internal pterygoid, and the upper cervical vertebræ, there is a space filled with cellular tissue, the pharyngo-maxillary interspace, in the posterior part of which are located the large vessels and nerves, and which lies almost directly backward from the pharyngo-palatine arch. The tonsils correspond to the anterior part of this interspace, so that both carotids are behind it,—the internal carotid about three-quarters of an inch and the external carotid about one inch distant from its lateral periphery."

The *laryngo-pharynx* (Plate II., Fig. 3), that portion extending from the greater cornua of the hyoid bone to the lower border of the cricoid cartilage, is chiefly interesting because of its relationship to the epiglottis and the superior margin of the larynx, which is situated in front of it. On its anterior surface, on each side, running obliquely downward and slightly forward, is the superior portion of the glosso-epiglottic fold. In the middle is the epiglottis. The posterior wall of this portion of the pharynx is not flat, as in the upper regions, but hollowed out. The anterior wall of the laryngo-pharynx is wanting in the middle, its place being taken by the opening of the larynx. Laterally, the anterior wall presents a fossa on each side,—the pharyngo-laryngeal sinus or pyramidal sinus,—which is about one-half inch in its antero-posterior diameter and somewhat broader in its transverse.

The laryngo-pharynx has its greatest breadth on a level with the cornua of the hyoid bone, and its narrowest part at its termination in the œsophagus on a level with the cricoid cartilage.

The *constrictor muscles* (Plate II., Fig. 4) of the pharynx are three,—superior, middle, and inferior. The *superior constrictor* muscles are square, and have a wide origin from the sphenoid and palate bones and from the tendinous and ligamentous tissues in the neighborhood. They arise from the lower third of the margins of the internal pterygoid plates and their hamular processes, from the adjacent portions of the palate bones and the reflected tendons of the *tensores palati*, from the pterygo-maxillary ligaments, and from a portion of the alveolar processes of the superior maxillæ and by fibres from the sides of the tongue. From these various points of

origin the bundles curve backward and are inserted into the median line, and also by a fibrous aponeurosis into the pharyngeal spine of the occipital bone.

The *middle constrictor* muscles, which are fan-shaped, overlap partially the superior constrictors at their lower parts. They arise from the hyoid bone and from the stylo-hyoid ligaments. The fibres of the muscles diverge from their origin and are inserted in the posterior median raphé of the pharynx.

The *inferior constrictors* of the pharynx, the thickest of the three, arise from the side of the cricoid and thyroid cartilages and spread backward and inward, and are likewise inserted into the median raphé of the pharynx. The lower fibres of the inferior constrictors blend with the muscular tissue of the œsophagus. Between the superior and middle constrictors the *stylo-pharyngei* muscles are situated. They are narrow and arise from the inner side of the styloid process, pass downward, and are in part inserted into the posterior portions of the thyroid cartilages, and also blend with the constrictor muscles. The function of the three constrictor muscles is that of propelling the food, after mastication, from the mouth to the œsophagus. The office of the stylo-pharyngei is to lift the pharynx upward for the reception of the food from the mouth.

The *mucous membrane* is applied to the entire internal surface of the pharynx, and is continuous with all the openings into it. As has been already stated in the article on the naso-pharynx, the mucous membrane is slightly adherent to the underlying tissue in the upper portion, while in the laryngeal region it becomes very loose. The structure of the mucous membrane is partly fibrous tissue and partly connective tissue. In the lower portion of the pharynx it is denser than in the upper portion. In the oro-pharynx and in the laryngo-pharynx the epithelium is tessellated and somewhat darker in color than above.

The glands, as usually described, are of the conglomerate and follicular varieties. In the naso-pharynx the conglomerate glands are more abundant, also on the pharyngeal surface of the soft palate, where they are in clusters. They are sparsely distributed lower down. The follicular glands are found in the oro-pharyngeal cavity as well as in the naso-pharynx. These follicular glands, or lymphoid follicles, are scattered irregularly in the deeper layers of the membrane and are grouped together as well on either side of the pharynx parallel with the posterior pillars of the fauces.

The *arteries* distributed to the pharynx are the facial, the internal maxillary, ascending pharyngeal branches of the external carotid artery; palatine twigs of the internal maxillary, and the ascending palatine branches of the facial, supply the soft palate. The tonsillar branches of the facial artery are distributed to the sides of the pharynx, to the root of the tongue, and to the tonsils. The ascending pharyngeals pass up through the deeper tissues of the neck and are distributed to the constrictor muscles and to the mucous membrane of the pharynx.

The *veins* form a dense net-work and may be considered as two plexuses :

the posterior plexus, which communicates with the venous system of the nasal mucous membrane; the anterior plexus, connected with the tongue, and emptying into the internal jugular vein by means of the pharyngeal vein.

The *lymphatics* are in two plexuses similar to the veins; they pass into the lymphatic glands, situated at the bifurcation of the common carotid, and also to the glands in the area of the greater cornua of the hyoid bone. In the tonsils, according to Retterer, the lymphatic capillary net-work occupies the entire follicular mass and forms a system of closed canals.

The *motor nerves* of the soft palate are portions of the lower division of the fifth, which are distributed to the tensor palati through the otic ganglion; the facial, supplying the levatores palati and azygos uvulæ, through the connection of its trunk with the Vidian by the petrosal nerves, and also branches of Meckel's ganglion which supply the palato-pharyngeus and palato-glossus.

The *sensory nerves* are derived from the second division of the fifth, and supply the anterior surface of the soft palate. Twigs of the glosso-pharyngeal, vagus, and spinal accessory are distributed to the lateral and posterior portions of the soft palate and the tonsil.

The *physiology* of the pharynx or fauces embraces the functions of *deglutition and articulation*.

The *act of deglutition* begins after the proper chewing and insalivation of the bolus of food have been accomplished. The food being properly prepared in the mouth is forced backward through the faucial isthmus by the tongue's being elevated against the roof of the oral cavity. When the bolus has reached the base of the tongue, it is grasped and forced downward by a series of contractions of the constrictors, and passes downward into the œsophagus and from thence into the stomach through the cardiac orifice. After the food has passed the isthmus, the palato-glossi contract and narrow the orifice and prevent the food from re entering the mouth. This movement on the part of the anterior pillars is simultaneous with contraction of the palato-pharyngei muscles, which forcibly advance towards the median line of the pharynx, and with the aid of the uvula and soft palate completely shut off the naso-pharynx and prevent the food from passing upward. These movements, purely voluntary in the oral cavity, become involuntary acts in the fauces. Simultaneously with the contraction of the faucial pillars, the larynx is drawn upward beneath the base of the tongue by the contraction of a set of muscles attached to the hyoid bone. By this upward movement of the larynx against the base of the tongue the epiglottis is pressed over the superior margin of the larynx, preventing the passage of food and liquids into the air-passages. The prevention of the entrance of fluids and solids into the larynx can be completely accomplished, even when the epiglottis is absent, by the constricting action of the muscular fibres placed around the superior margin of the lateral folds of the larynx. The pharyngeal wall is also elevated by the raising of the larynx assisted

by the palato-pharyngei muscles. All these movements place the bolus of food within the easy grasp of the middle and lower constrictor muscles of the pharynx, and when seized by them it is carried downward into the cesophagus, the larynx at the same time resuming its normal position.

Articulation.—The expiratory blast of air coming from the lungs is thrown into vibrations by the action of the free edge of the vocal cords, producing waves of sound, which are amplified as they proceed upward and are formed into articulate language by the diverse movements of the soft palate, tongue, cheeks, and lips. The soft palate and uvula, hanging as a curtain between the oral and nasal cavities, direct the sound-waves into one or other cavity, by this means regulating the character of the tone,—in the one case producing nasal, in the other purely oral tones. It is probably true that the soft palate exercises a wider influence than this, as is seen in cases of loss of motion in the palate, where a very marked change in articulation is observed. Articulate language is produced by changing the shape of the vocal tube by means of the lips, tongue, and palate, the sound-waves in some cases being allowed to pass through the mouth, while in other instances they are interrupted or completely arrested. In the formation of all pure vowel sounds the soft palate is raised, the vowel pronounced modifying the closure of the upper pharynx. Consonants are formed by the interruption or arrest of the sound-producing waves, by the tongue, lips, or teeth,—the action of each giving name to the class of sounds produced by it, as gutturals, labials, and dentals.

The *function of the tonsils* is still in doubt. The view that the tonsils are an aggregation of follicles, whose function is to secrete a lubricating fluid to moisten the bolus of food, has few adherents at the present day. Frey's investigations, confirmed by subsequent observers, show that the tonsils are chiefly composed of lymphoid tissue. These investigations have probably classified the structure properly, anatomically considered, but they have not, as yet, made clear the physiological function of the tonsil, although its absorbent function may be conceded.

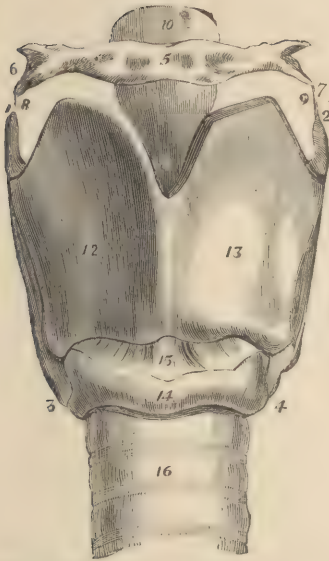
PART II.

ANATOMY AND PHYSIOLOGY OF THE LARYNX.

The *larynx*—the “organ of the voice”—is a cartilaginous, triangular-shaped box situated between the hyoid bone above and the upper margin of the trachea below. It is bounded behind by the anterior wall of the lower portion of the pharynx, while in front cutaneous tissue and the thyroid body cover its most prominent part. At the sides the great vessels of the neck are in close proximity. The larynx forms a very marked feature in the regional anatomy of the neck, and its most prominent portion is familiarly known as the “pomum Adami,” or Adam's apple. This car-

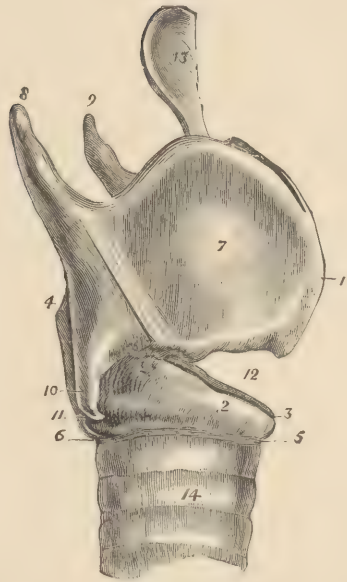
PLATE III.

FIG. 6.



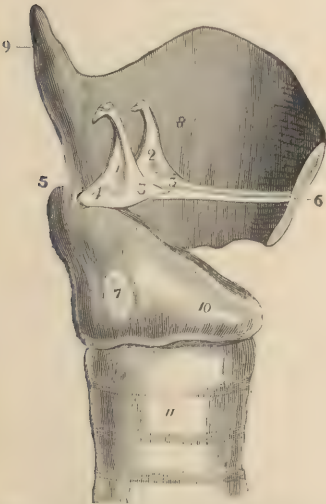
FRONT VIEW OF THE LARYNX, THYROID CARTILAGE IN POSITION.—1, 2, superior cornua of thyroid; 3, 4, inferior cornua of thyroid; 5, hyoid bone; 6, 7, cornua of hyoid bone; 8, 9, thyrohyoid ligament; 10, 11, epiglottis; 12, 13, alae of thyroid cartilage; 14, cricoid cartilage; 15, cricoid membrane; 16, trachea. (Browne.)

FIG. 7.



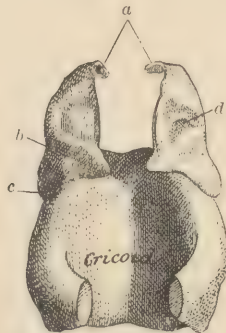
SIDE VIEW OF THE LARYNX.—1, prominence of thyroid cartilage (*pomum Adami*); 2, cricoid cartilage; 3, 4, upper border of cricoid cartilage; 5, 6, lower border of cricoid cartilage; 7, thyroid cartilage; 8, 9, superior cornua of thyroid cartilage; 10, right inferior cornu of thyroid cartilage; 11, articulation of the thyroid cartilage with the cricoid cartilage; 12, crico-thyroid aperture; 13, epiglottis; 14, trachea. (Browne.)

FIG. 8.



SIDE VIEW OF THE LARYNX, SHOWING THE INTERIOR, THE RIGHT PLATE OF THE THYROID CARTILAGE BEING REMOVED.—1, 2, arytenoid cartilages; 3, 3, vocal processes of the arytenoids; 4, muscular process of the right arytenoid; 5, upper border of cricoid cartilage; 6, 3, 3, vocal bands; 7, facet for articulation with the lesser horn of the thyroid cartilage; 8, left plate of thyroid; 9, left superior horn of the thyroid cartilage; 10, cricoid cartilage; 11, trachea. (Browne.)

FIG. 9.



THE CRICOID CARTILAGE, THE ARYTENOID CARTILAGES, AND THE CARTILAGES OF SANTORINI: the structures last named have been called *cornicula laryngis*.—a, cornicula laryngis; b, vocal process; c, attachment of crico-arytenoid, posticus and lateralis; d, arytenoid. (H. Allen.)

tilaginous framework varies greatly in prominence in the sexes, its projection in front in males being greater not only by reason of its increased size but also because of a scanty distribution of adipose tissue. In women and children the diminished volume and great amount of fatty tissue in this region render the prominence much less perceptible.

Before proceeding to the consideration of the laryngeal cartilages and their attachments, it may be of interest to describe briefly the hyoid bone, which has so intimate a connection with the larynx.

The *hyoid bone* (Plate II., Fig. 5), horseshoe-shaped or like the Greek letter υ , lies in the region of the neck between the tongue and the larynx. It is placed near the surface, and its outlines can be traced by the fingers upon manipulation. The hyoid bone is composed of a *body* and two pairs of processes or *horns* (cornua). These horns are described as the greater and lesser. The greater horns are long club-shaped processes which gradually narrow and terminate in bulbous extremities. The direction of the greater horns is upward and backward from the body of the bone. The lesser horns resemble small pegs, and ascending form a right angle at their origin with the junction of the body and greater horns of the bone. The hyoid bone lies with its convexity directed forward, its concavity backward. The position and direction of the greater horns aid in maintaining the lower pharynx in a patulous condition. The function of the hyoid bone in deglutition has already been considered in the article on the anatomy of the pharynx.

The framework of the larynx consists of *true cartilages* and *fibro-cartilages*. The true cartilages composing the framework of the larynx are the thyroid cartilage, the two arytenoid cartilages, and the cricoid cartilage. The fibro-cartilages are the epiglottis, and two pairs of small fibro-cartilages,—the cartilages of Wrisberg and Santorini. The diminutive sesamoid fibro-cartilages, varying in number, cannot be considered as forming part of the framework of the larynx. The cartilages entering into the framework are bound together by ligaments and muscles and aponeurotic tissue. Important ligaments likewise unite the larynx to the hyoid bone, the tongue, and the trachea.

The *thyroid cartilage* (Plate III., Figs. 6 and 7), the largest of the cartilages entering into the framework of the larynx, has the form of a shield; and not only has it the *form* but it performs the functions of a shield, protecting the essential parts of the vocal organs,—the vocal bands. The thyroid cartilage consists of two wings or quadrilateral plates united in front at a sharp angle by a centre-piece called the *lamina mediana cartilaginæ thyroideæ*: these wings expanding outward and backward form the lateral walls of the larynx. An admirable protection is afforded to the vocal organs by this arrangement of the lateral walls. Anteriorly and above at the junction of the two broad plates or wings a deep sulcus or U-shaped notch is seen,—the thyroid notch. The posterior border of each wing is marked by two prolongations above and below,—the superior and

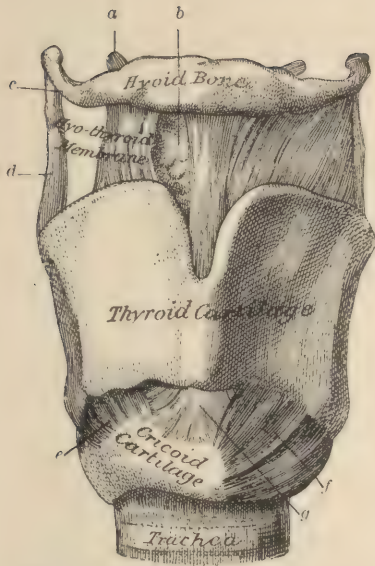
inferior horns or *cornua* of the thyroid cartilage. The superior cornua are much larger than the inferior cornua, and are directed upward and slightly backward. The inferior cornua are thicker and stronger than the superior, and are furnished upon their inner surfaces with facets for articulation with the cricoid cartilage.

The *arytenoid cartilages* (Plate III., Figs. 8 and 9), two in number, are pyramidal in shape, their apices pointing upward and inward, and when placed together they bear a resemblance to the mouth of a pitcher. They rest by their bases upon the superior surface of the posterior portion of the cricoid cartilage. These cartilages are so situated that the internal faces are nearly parallel. The anterior angle of each arytenoid cartilage is prolonged, and is known as the *vocal process*. The base of each cartilage presents a broad oval concavity for articulation with the facet or eminence upon the cricoid cartilage: this depression is much larger than the facet with which it articulates, and allows great freedom of motion. The posterior end of the base projects from the posterior surface and forms the *musculo-articular process or tubercle*. The arytenoid cartilages are the most movable of the laryngeal cartilages, and are important factors in the mechanism of speech.

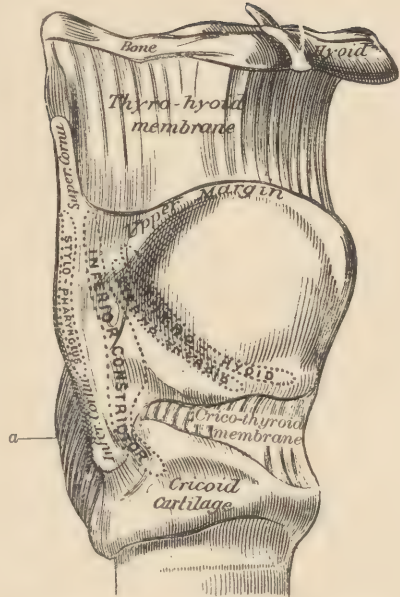
The *cricoid or ring cartilage* (Plate IV., Fig. 10) is the foundation-cartilage of the larynx, all the other portions of the larynx resting upon it. The cricoid cartilage may be considered as the upper ring of the trachea modified and enlarged to afford support to the other laryngeal cartilages; its shape is that of a signet ring, from which it derives its name. The posterior half is the broad expanded portion corresponding to the seal of the ring; its anterior half is small, rounded, and convex. The upper surface of the posterior half is marked by two facets for articulation with the arytenoid cartilages, the greatest diameter of these facets lying transversely. On the outer portion of the posterior half of the cartilage are two small depressions,—the points of articulation with the inferior cornua of the thyroid cartilage. The under surface of the cricoid is attached to the upper ring of the trachea. The lower rim of the cricoid cartilage is nearly horizontal in position, but its upper margin, from the greater depth of the posterior part, inclines from in front upward and backward. In the median line, posteriorly, is an elevated ridge which serves as a partial attachment for the œsophagus, while in front there is a space between this part of the cartilage and the thyroid occupied by the crico-thyroid membrane, surgically a very important structure. The cricoid cartilage marks the level of the commencement of the œsophagus.

The *epiglottis* (Plate III., Figs. 6 and 7) is a thin, leaf-shaped plate of fibro-cartilage situated at the front of the larynx. It is rounded above and narrow below, ending in an elongated pedicle which is attached to the receding angle of the thyroid cartilage immediately below the thyroid notch. This attachment allows great freedom of movement. Its anterior (lingual) surface is convex from side to side, and concave from above down-

FIG. 10.

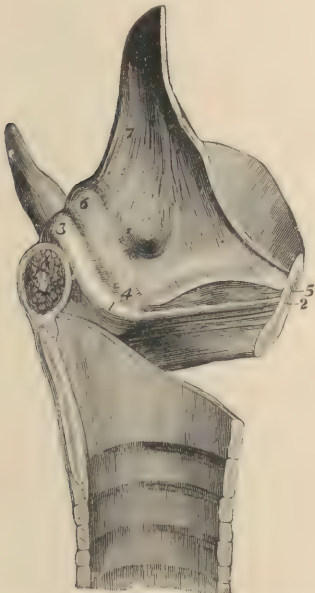


THE HYOID BONE AND LARYNX, WITH LIGAMENTS, seen from in front.—a, lesser horn; b, fat beneath hyo-thyroid membrane; c, great horn; d, lateral thyro-hyoid ligament; e, crico-thyroid (deep portion); f, crico-thyroid (superficial portion); g, crico-thyroid membrane. (H. Allen.)



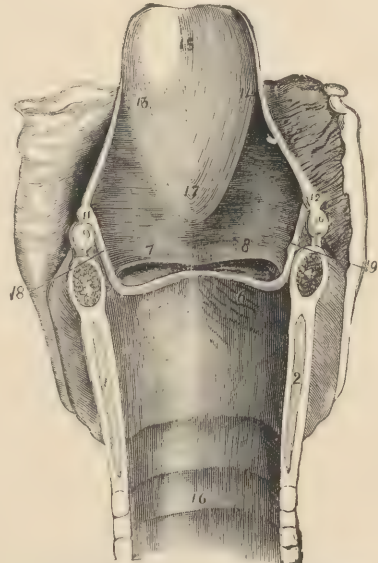
The same, seen from the side.—a, capsular ligament. (H. Allen.)

FIG. 11.



SIDE VIEW OF THE LARYNX; SHOWING THE LEFT VENTRICLE OF MORGAGNI, LEFT EPIGLOTTIC LIGAMENT, ETC.—1, 2, left vocal band; 3, elevation indicating the site of the left cartilage of Santorini; 4, 5, left ventricular band, false vocal band; 5, 4, 2, 1, entrance to left ventricle of Morgagni; 6, elevation indicating the site of the left cartilage of Wrisberg; 7, aryteno-epiglottidean (ary-epiglottic) ligament; 8, arytenoid muscle. (Browne.)

FIG. 12.



VIEW OF THE LARYNX OPENED FROM BEHIND.—1, 2, cricoid cartilage; 3, 4, arytenoid muscle; 5 and 6, vocal bands; 5, 7, 6, 8, entrance to the ventricles of Morgagni; 7, 8, ventricular bands, superior thyro-arytenoid ligaments; 9, 10, cartilages of Santorini; 11, 12, cartilages of Wrisberg; 11, 13, 12, 14, aryteno-epiglottidean (ary-epiglottic) ligaments; 15, epiglottis; 16, trachea; 17, cushion of epiglottis; 18 and 19, cuneiform cartilages. (Browne.)

ward, its superior border being curved forward over the base of the tongue. The posterior (laryngeal) surface is concave above and convex below. It is marked by numerous pits for the reception of mucous glands.

The *cartilages of Santorini* (Plate III., Fig. 9) are small fibro-cartilages situated in the mucous membrane directly over the apex of each arytenoid cartilage. They are also known as the *cornicula laryngis*. These cartilages are freely movable, and are generally united to the arytenoid cartilages by fibro-cartilaginous attachment. Occasionally they are distinct or separate from the arytenoid cartilages.

The *cartilages of Whisberg*, or *cuneiform cartilages*, are small rod-shaped nodules of fibro-cartilage which are lodged between the layers of the aryteno-epiglottic fold in front of the arytenoids and in front of the cartilages of Santorini.

The *posterior sesamoid cartilages*, according to Luschka, are frequently found in both sexes. They are very small, oblong, and are attached by delicate ligaments above to the cartilages of Santorini and below to the arytenoid cartilages. Their position is close to the lateral margins of the arytenoid cartilages.

The *anterior sesamoid cartilages*, which are generally present, are about the size of the head of a pin, and are embedded in the anterior part of the vocal bands. They are united to the thyroid cartilage by tough fibrous tissue. The inter-arytenoid cartilage, which is but seldom present, is also described by Luschka as a little nodule sometimes found between the arytenoid cartilages.

Having considered separately the cartilages composing the framework of the larynx, the ligaments which bind the cartilages to one another and to other parts are next to be considered. The ligamentous attachment of the thyroid cartilage to the hyoid bone is known as the *thyro-hyoid ligament* or *thyro-hyoid membrane*. (Plate IV., Figs. 10 and 11.) It is composed of three portions,—a median and two lateral portions.

The *median ligament* extends between the whole of the superior border of the thyroid cartilage and the upper posterior border of the hyoid bone. By this attachment the body of the hyoid bone is drawn obliquely downward and forward. This ligamentous membrane is thicker in the middle than at the sides. In the space between the thyro-hyoid membrane and the posterior border of the hyoid bone is a well-defined bursa. A second bursa is occasionally present between the greater horn of the hyoid bone and the posterior border of the thyro-hyoid ligament.

The *lateral thyro-hyoid ligaments* (Plate IV., Fig. 10), of which there are two, are short, rounded bundles of fibro-elastic tissue which connect the superior horn of the thyroid cartilage to the greater horn of the hyoid bone.

The *epiglottis* is connected by ligamentous tissue not only to the thyroid cartilage but also to the hyoid bone. The ligamentous connection between the hyoid bone and the epiglottis is known as the *hyo-epiglottic*

ligament. It arises near the apex of the epiglottis, and is inserted into the posterior surface of the body of the hyoid bone. The attachment of the epiglottis to the receding angle of the thyroid cartilage is by a long, rounded, and flexible bundle of fibro-elastic tissue known as the *thyro-epiglottic ligament*. This ligament extends between the thyroid cartilage and the front of the epiglottis. The epiglottis is also attached to the base of the tongue by three folds, a median and two lateral. The *median glosso-epiglottic ligament* is more prominently marked and composed of true ligamentous tissue, while the two lateral folds are simply reflections of the pharyngeal aponeurosis. The thyroid cartilage is connected with the cricoid cartilage by three ligaments,—the crico-thyroid membrane and the capsular or lateral ligaments.

The *crico-thyroid membrane*, or *median ligament* (Plate IV., Figs. 10 and 11), is a thick, elastic membrane which fills the space left vacant between the upper border of the cricoid cartilage and the lower border of the anterior portion of the thyroid cartilage. Laterally it becomes blended with the anterior insertion of the vocal bands. This intimate connection of the crico-thyroid membrane with the two vocal bands explains why in the operation of thyrotomy or splitting of the thyroid cartilages there so often results impairment of the integrity of the voice. This result follows the loss of the normal tension of the crico-thyroid membrane from surgical injury or a traumatism, the membrane failing to make satisfactory union, and it is *not* solely dependent upon the improper coaptation of the halves of the thyroid cartilages. It lies directly beneath the skin, in a median line, while at the sides it is covered by the crico-thyroid muscles. The crico-thyroid membrane is slightly convex in front, and is composed of yellow elastic tissue. It is penetrated by minute arteries and veins which supply the laryngeal mucous membrane. A small arterial branch running horizontally forms an anastomosis between the crico-thyroid arteries of both sides. The inner surface of the crico-thyroid membrane over its middle portion is covered by mucous membrane, while at the sides the thyro-arytenoid and lateral crico-arytenoid muscles cover it. The lateral crico-thyroid ligaments complete the articulation of the thyroid with the sides of the cricoid by the articulation of the inferior horns of the thyroid with the sides of the cricoid. Each lateral ligament is composed of two stout slips,—one extending from the cricoid cartilage upward and inward and the other passing outward. These slips serve to protect a capsular ligament lined with synovial membrane and situated between the cricoid and thyroid cartilages. The *crico-arytenoid*, the *capsular ligament* of the crico-arytenoid joint, is loose and permits of free extended motion of the arytenoid upon the cricoid cartilage. The articulation of the facets is sometimes spoken of as a “screw-like articulation,” and also as a “hinge-like joint.”

The *crico-tracheal ligament* is a firm band of fibrous tissue which unites the lower margin of the cricoid to the upper ring of the trachea.

The Cavity of the Larynx (Plate IV., Figs. 11 and 12).—The epiglottis, lying in the median line at the base of the tongue, overhangs the orifice of the laryngeal cavity. The crest of the epiglottis varies greatly in its normal shape, as does also the angle at which it overhangs the cavity of the larynx. The crest may be rounded, or it may be curved upon itself (described as “omega”-shaped, this latter shape occurring in children), or narrowing to a point (described as “lanceolated”), besides various asymmetrical modifications of its shape. The epiglottis also varies in its position relative to the laryngeal aperture, in some instances being markedly overhanging, while in others it is almost erect. On the lower or laryngeal surface of the epiglottis, near its root, is a rounded eminence, the *cushion of the epiglottis*, composed of glands and fatty matter. Extending from the sides of the epiglottis to the apex of each arytenoid cartilage is a fold of mucous membrane, the aryteno epiglottic fold (“ary-epiglottic”). This fold is composed of ligamentous and muscular fibres, and at the edge of this fold, over the arytenoids, appear the cartilages of Santorini, and in front of the cartilages of Santorini project the cartilages of Wrisberg. These ary-epiglottic folds form the lateral boundaries of the superior margin of the laryngeal cavity,—the arytenoid cartilages posteriorly and the epiglottis anteriorly completing the superior margin. Passing into the cavity of the larynx, two folds of mucous membrane appear, one on each side (the ventricular bands or false vocal cords or superior thyro-arytenoid ligaments), which extend in a nearly horizontal plane from the receding angle of the thyroid to the arytenoid cartilages. These ventricular bands are supported by bundles of elastic tissue whose attachments in front are to each side of the receding angle of the thyroid cartilage. Behind, these bands are attached to the interior surface of the arytenoid cartilages. “The ventricular bands are capable of being closely approximated, and by this means the upper division of the cavity of the larynx is separated from the two lower ones.” Below the ventricular bands slits of considerable length are found, which are known as the *ventricles of the larynx* (ventricles of Morgagni). These slits extend nearly the entire length of the ventricular bands. They are bounded externally by the thyro-arytenoid muscles, above by the ventricular bands, below by the true vocal bands. In the anterior portion of each ventricle is found a narrow pouch or cavity,—the *sacculus laryngis*. This sac is membranous, and extends between the ventricular band and the wings of the thyroid cartilages. The cavity extends upward and backward, varying much in capacity, reaching as far upward as the upper border of the thyroid cartilage, and in some instances has been traced as far upward as the base of the tongue. Immediately below the ventricles of the larynx and parallel with the ventricular bands are situated the *true vocal bands* or inferior thyro-arytenoid ligaments (cords, tongues, or lips) (Plate IV., Figs. 11 and 12), two strong, elastic fibrous bands made up of yellow elastic tissue. Their length is about three-quarters of an inch in men and about one-half inch in women. These vocal bands are practi-

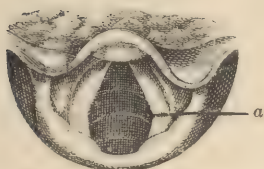
cally the ligamentous borders of the thyro-arytenoid or vocal muscles. A cross-section of the vocal bands shows them to be triangular or prism-shaped, the apex of each triangle or prism presenting to its fellow. They are firmly attached along their whole length to the thyroid cartilages, their only free portion being their thin opposing edges. The vocal bands are *white*, in marked contrast to the red ventricular bands above. In front they are inserted into the lower part of the receding angle of the thyroid cartilage within the attachment of the thyro-arytenoid muscle. Behind, the vocal bands have three distinct insertions, one band of fibres being inserted into the vocal process of the arytenoid cartilage, another into the anterior face of the arytenoid, while the third is inserted into the capsular ligament and anterior face of the expanded portion of the cricoid cartilage. That portion of the larynx which extends from the inferior surface of the vocal bands to the lower border of the cricoid cartilage is the narrowest part of the laryngeal cavity, and remains constant in its diameters, being circumscribed by the cricoid or ring cartilage. This smallest and lowest portion of the laryngeal cavity leads into the trachea.

The cavity of the larynx is generally divided into three parts. The first and largest is called the *supra-glottic*. It is that portion of the laryngeal cavity which lies above the ventricular bands. It is heart-shaped, the broader part being situated in front. The second or *glottic* division is that portion of the cavity which lies between the ventricular bands and the vocal cords, including the ventricles of Morgagni. The third or *infra-glottic* division extends from the inferior surface of the vocal bands to the lower border of the cricoid cartilage. The *glottic* division of the laryngeal cavity is in every particular the most important of the three divisions. In this portion of the larynx tone is produced and respiration from the lungs is carried on.

The space between the vocal bands is technically known as the *rima glottidis*, or *chink of the glottis* (Plate V., Fig. 13). In repose the rima glottidis is elliptical,—longer in men than in women,—but the form varies greatly in different actions of the bands; it is practically obliterated during the production of certain tones, while in full inspiration it becomes triangular in shape. The anterior junction of the vocal bands is called the *anterior commissure*. Posteriorly, the space between the bands over the arytenoid cartilages is known as the *inter-arytenoid space*. During phonation, this inter-arytenoid space is so encroached upon by the action of the arytenoids that it becomes a mere slit or fissure, which is termed the *posterior commissure* of the vocal bands. Anteriorly, the vocal bands are always in contact; posteriorly, they are separated to the extent of half an inch, and are in contact only during phonatory efforts. In addition to the ligaments already described, uniting separate portions of the cartilaginous framework of the larynx, there is a general investment of aponeurotic tissue which is closely adherent to the cartilaginous framework and is directly covered by the mucous membrane covering the larynx.

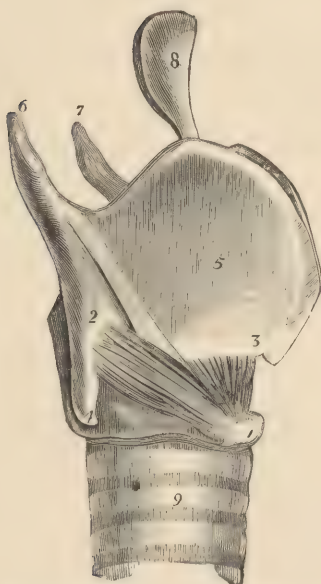
PLATE V.

FIG. 13.



THE RIMA GLOTTIDIS, *a*. (H. Allen.)

FIG. 14.



SIDE VIEW OF THE LARYNX, SHOWING RIGHT CRICO-THYROID MUSCLE.—1, 2, 3, crico-thyroid muscle; 4, right inferior cornu of thyroid; 5, thyroïd cartilage; 6, 7, superior cornua of thyroid; 8, epiglottis; 9, trachea. (Browne.)

FIG. 15.



MUSCLES OF THE LARYNX, SEEN FROM BEHIND.—1, 2, cricoid cartilage; 3, 4, arytenoid muscle; 5, 6, thyroid cartilage; 7, 8, hyoid bone; 9, 12, cartilages of Santorini; 10, 13, cartilages of Wrisberg; 11, 15, 14, epiglottis; 16, trachea; 17, thicker (cushion) portion of the epiglottis; 18, 19, posterior crico-arytenoid muscles; 20, 21 and 22, 23, arytenoid. (Browne.)

FIG. 16.



SIDE VIEW OF THE LARYNX, SHOWING INTERIOR OF THE LEFT HALF.—1, 2, 3, 4, left vocal band, and the thyro-arytenoid muscle; 5, left arytenoid cartilage; 6, 7, cricoid cartilage; 5, 7, lateral crico-arytenoid muscle. (Browne.)

The *muscles of the larynx* are the *crico-thyroids*, the *posterior crico-arytenoids*, the *lateral crico-arytenoids*, the *arytenoid*, the *thyro-arytenoids*, the *thyro-epiglottics*, and the *aryteno-epiglottics*.

The two *crico-thyroid* muscles (Plate V., Fig. 14), each consisting of two bundles, are fan-shaped, and arise from the anterior portion and sides of the cricoid cartilage and divide into two parts, one set of fibres passing obliquely backward and upward, the other bundle passing almost directly upward. They are inserted into the inner portion of the lower borders of the thyroid cartilage in front, while the other fascicles pass obliquely upward and backward and are inserted into the thyroid cartilage near the base of the lower horns. The triangular space left between the anterior borders of the crico-thyroid muscles is occupied by the crico-thyroid membrane. The crico-thyroid muscle—formerly supposed to act from the cricoid as a fixed point, drawing the thyroid downward—is now generally conceded to reverse this process, and, with the thyroid as a fixed point, to draw the cricoid upward and backward, by this movement elongating and rendering tense the vocal bands.

The *posterior crico-arytenoid* muscles (Plate V., Fig. 15) are triangular, arise from the entire lateral halves of the posterior surfaces of the cricoid cartilage, and are inserted into the muscular processes of the bases of the arytenoid cartilages. According to some observers, these muscles are divided into two bundles, the outermost fibres drawing the arytenoid cartilage directly outward and away from its fellow, the inner fibres rotating the arytenoid cartilages on their bases. These muscles abduct and rotate the arytenoid cartilages, and are called “glottis openers.” In the action of these muscles the cricoid cartilage is the fixed point and draws the outer angle of the arytenoid cartilage backward, by which the vocal process to which the vocal band is attached is thrown outward, and in this way the glottis is widened.

The *lateral crico-arytenoid* muscles (Plate IV., Fig. 12) arise from the upper margin of the sides of the cricoid cartilage; the fibres pass upward and backward, and are inserted into the outer angle of the arytenoid cartilage in front of the insertion of the posterior crico-arytenoid muscles. With these muscles the cricoid is again the fixed point, and they draw the outer angles of the arytenoid cartilages forward; by this movement the vocal processes are thrown inward and thereby close the glottic opening. These muscles then act as adductors of the vocal bands.

The *thyro-arytenoids* (Plate V., Fig. 16)—the true vocal muscles—have their origin from the lower portion of the receding angle of the thyroid cartilage, and are continuous with the crico-thyroid membrane. They are composed of broad, thin bundles of straight muscular fibres passing horizontally backward across the sides of the anterior portion of the larynx immediately beneath and to the outer side of the vocal bands, and are inserted into the vocal process of the arytenoids. Each muscle may be divided into two parts, called the *internal* and the *external fasciculi*. The

internal fasciculi pass backward and are attached to the vocal band in its entirety, while posteriorly they are inserted into the external surface of the vocal process. The *external* portion, intimately associated with the internal, is less compact, and sends delicate bundles upward to the outer wall of the laryngeal sac, which pass under the sacculus laryngis and are inserted into the anterior face of the arytenoid cartilages. The action of the thyro-arytenoid muscle as a whole is to approximate the arytenoid cartilages to the thyroid, and in this manner shorten and relax the vocal bands. The action of the *internal* fibres controls the free border of the vocal bands and brings the edges of the bands together. The action of the *external* fasciculi is chiefly concerned in the relaxation of the bands, and they also take part in the compression of the sacculus laryngis.

The *superior thyro-arytenoid*, sometimes called the oblique thyro-arytenoid muscles, are additional bundles of muscular fibres which have their origin just above the origin of the thyro-arytenoid muscles. They pass backward, outward, and downward, and are inserted into the muscular processes of the arytenoid cartilages. They serve as adjuncts to the action of the thyro-arytenoid muscles, and are supposed to be particularly concerned in the more delicate movements of the singing voice.

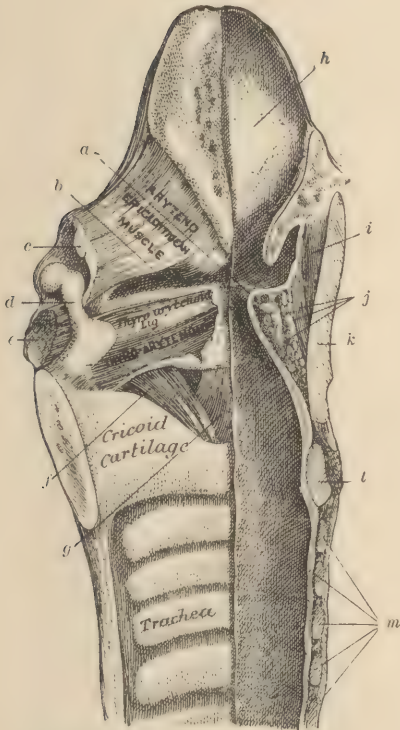
The *arytenoid* (Plate V., Fig. 15), a single muscle, is square: it is attached to the posterior and concave surface of the arytenoid cartilage. It passes to the corresponding parts of the opposite cartilage. It is composed of two oblique parts and one transverse or circular part. The transverse portion,—the deepest,—sometimes designated as the true arytenoid, passes horizontally across from one cartilage to the other. The oblique fibres—more superficially placed—pass from the apex of one cartilage to the base of the other and back again. The action of the arytenoid muscle is to approximate and rotate the arytenoid cartilages, and to aid in adducting the vocal bands and in closing that portion of the rima glottidis which is included between the vocal processes.

The *thyro-epiglottic* muscles (Plate VI., Fig. 17) arise at the side of the receding angle of the thyroid cartilage just external to the thyro-arytenoid muscles. They pass outward around the sacculus laryngis, some fibres being lost in the ary-epiglottic fold, while others are inserted into the sides of the epiglottis. This muscle aids in depressing the epiglottis.

The *aryteno-epiglottic* (Plate VI., Fig. 18) or *ary-epiglottic* muscles arise from the posterior face of the base of the arytenoid cartilage and pass obliquely upward to the apex of the opposite arytenoids. They are loosely attached to the apices, and then pass forward, some of the fibres being lost in the ary-epiglottic fold, while others pass forward and upward over the upper and inner portions of the sacculus laryngis and are inserted into the edge of the epiglottis, a few of these fibres being continued over the anterior surface of the epiglottis. These muscles may be considered as sphincters of the superior margin of the laryngeal cavity, and possibly they aid in compressing the laryngeal sac.

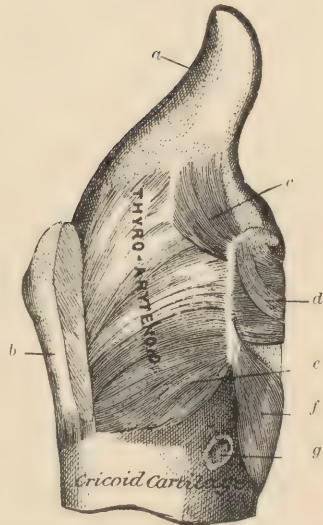
PLATE VI.

FIG. 17.



THE LARYNX OPENED FROM BEHIND: on the left side the structures are dissected from the interior aspect.—*a*, vocal cord; *b*, ventricle; *c*, cartilage of Wrisberg; *d*, arytenoid cartilage; *e*, arytenoid muscle; *f*, lateral crico-arytenoid; *g*, crico-thyroid membrane; *h*, epiglottis; *i*, thyro-epiglottidean fasciculus; *j*, thyro-arytenoid muscle; *k*, thyroid cartilage; *l*, cricoid cartilage, in section; *m*, tracheal rings, in section. (H. Allen.)

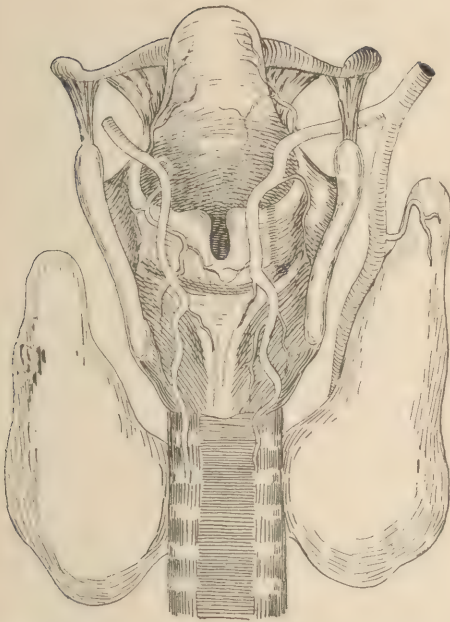
FIG. 18.



THE LARYNX, DISPLAYING THE INTRINSIC MUSCLES, AFTER THE REMOVAL OF ONE SIDE OF THE THYROID CARTILAGE.—*a*, epiglottis; *b*, thyroid cartilage; *c*, aryteno-epiglottidean muscle; *d*, arytenoid; *e*, lateral crico-arytenoid; *f*, posterior crico-arytenoid; *g*, articulation with thyroid cartilage. (H. Allen.)

PLATE VII.

FIG. 19.



Arterial supply of the larynx, posterior view, showing the distribution of the superior laryngeal artery. (Bosworth.)

FIG. 20.



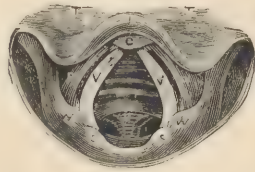
Arterial supply of the larynx, anterior view, showing the distribution of the inferior laryngeal artery. (Bosworth.)

FIG. 21.



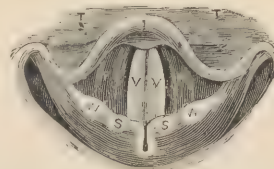
THE LARYNX IN GENTLE BREATHING.—T, T, tongue; V, V, vocal cords; P, P, ventricular bands; L, epiglottis; W, W, cartilages of Wrisberg; S, S, cartilages of Santorini. (Browne.)

FIG. 22.



THE LARYNX IN DEEP BREATHING.—P, P, ventricular bands or pocket ligaments, formerly called false vocal bands; B, bifurcation of trachea; C, cushion of epiglottis; S, S, cartilages of Santorini; W, W, cartilages of Wrisberg; W P, windpipe. (Browne.)

FIG. 23.



THE LARYNX IN TONE-PRODUCTION.—T, T, tongue; V, V, vocal bands; P, P, ventricular bands; W, W, cartilages of Wrisberg; S, S, cartilages of Santorini; L, epiglottis. (Browne.)

The *mucous membrane* which lines the cavity of the larynx is continuous with that of the pharynx, and also with that of the trachea and bronchi. It is loosely attached to the upper or lingual surface of the epiglottis and over the ary-epiglottic muscles (forming the ary-epiglottic folds); it is also loosely adherent over the arytenoidal or posterior portion of the larynx. It is more firmly adherent to the superior thyro-arytenoid ligament, forming the ventricular band, and from there is reflected to the sacculus laryngis; it is most adherent to the true vocal bands. Below the rima glottidis it is firmly adherent to the cricoid cartilage and also to the trachea and bronchi. The epithelial layer in certain portions of the laryngeal cavity, as well as over certain portions of the epiglottis, is columnar and ciliated, while in other parts of the cavity it is squamous. It is columnar and ciliated in that portion of the laryngeal cavity which is situated below the ventricular bands, with the exception of the true vocal bands, which are covered with squamous epithelium. Ciliated epithelium is also found on the lower half of the posterior or lingual surface of the epiglottis. In the remaining portion the epithelium is of the squamous variety.

Glands.—The mucous membrane of the larynx is supplied with numerous muciparous glands; these are especially numerous on the laryngeal face of the epiglottis, over the ary-epiglottic folds, and over the arytenoidal portion, as well as in the sacculus laryngis.

Arteries.—The arteries supplying the larynx are derived from branches of the superior and inferior thyroid arteries. The superior thyroid is a branch of the external carotid, while the inferior thyroid is given off from the thyroid axis, the axis being a branch of the subclavian artery. The superior thyroid again subdivides, forming anterior and posterior laryngeal branches.

The anterior set is composed of the superior and inferior laryngeal arteries. The *superior laryngeal* artery (Plate VII., Fig. 19) passes inward between the great horn of the hyoid bone and the upper border of the thyroid cartilage. It enters the larynx through the thyro-hyoid membrane. It is distributed to the epiglottis, to the mucous membrane, muscles, and glands of the upper and anterior portion of the larynx.

The *inferior laryngeal* artery (Plate VII., Fig. 20)—also known as the crico-thyroid artery—also arises from the superior thyroid artery opposite the lower border of the thyroid cartilage, passes directly inward, and comes in contact with the crico-thyroid membrane; it here divides into two branches, the *inferior* branch anastomosing with a branch of its fellow on the opposite side; it passes through the crico-thyroid membrane, enters into the larynx, and is distributed to the mucous membrane below the vocal bands. The upper branch passes beneath the border of the thyroid cartilage and anastomoses with branches of the superior laryngeal artery. The second or *posterior* group is made up of the posterior laryngeal arteries, branches of the inferior thyroid artery; they pass upward in company with the recurrent laryngeal nerves until they arrive at the posterior wall of the

larynx near the articulation of the crico-arytenoids. At this point each divides into two branches, one of which is distributed to the posterior crico-arytenoid muscles, while the other branch passes upward and anastomoses with branches of the superior laryngeal artery. The larger branches are situated near the cartilaginous framework, while the smaller branches subdivide into a fine net-work and are distributed to the surface.

The *veins* of the larynx follow the arteries, and the veins of the mucous membrane of the muscles empty into the thyroid and from there empty into the internal jugular.

The *nerves* supplying the larynx are derived from the pneumogastric; the mucous membrane and the crico-thyroid muscles are supplied by the *superior laryngeal* nerve, and the remaining muscles are supplied by the *inferior* or *recurrent laryngeal* nerve. The *superior laryngeal* nerve supplies general sensation to the mucous membrane and motor power to the crico-thyroid muscle and to the arytenoid muscle. After its origin from the inferior ganglion of the pneumogastric nerve, it passes down near the side of the pharynx and divides into two branches, above the superior border of the thyroid cartilage. The *external* branch passes down on the outer wall of the larynx and penetrates the crico-thyroid muscle. The *internal* branch passes through the thyro-hyoid membrane in company with the superior laryngeal artery, and is distributed to the entire mucous membrane of the laryngeal cavity, and also sends filaments to the base of the tongue as well as to the arytenoid muscle. This internal branch connects with the recurrent laryngeal nerve. The motor fibres supplying the arytenoid muscles and the crico-thyroid muscles are supposed to be derived from the spinal accessory nerves. The distribution of the *inferior* or recurrent laryngeal nerve differs on the two sides: on the right side on a level with the right subclavian artery it winds around it from before backward, and passes upward and inward near the trachea; on the left side it begins on a level with the concavity of the arch of the aorta, passes around this vessel from before backward, and, ascending to near the trachea, passes upward between the trachea and the œsophagus. The nerves on either side, after reaching the site of the articulation of the lesser horn of the thyroid cartilage with the cricoid cartilage, enter the laryngeal cavity and give off branches to the posterior crico-arytenoid muscles, and also send sensitive branches which pass through the muscles and are distributed to the mucous membrane of the laryngeal cavity below the glottis. Branches of this nerve are also distributed to the lateral crico-arytenoids, the arytenoid, the thyro-arytenoids, and the thyro-epiglottic and aryteno-epiglottic muscles.

The Lymphatics.—The mucous membrane of the laryngeal cavity shows a dense net-work throughout of lymphatics. They unite on either side to form two trunks, one above each ventricle and one on each side below the cricoid cartilage. The union of all the lymphatics which are distributed to the epiglottis and to that portion of the larynx above the vocal bands makes up the superior trunk. This trunk emerges from the laryngeal

cavity above the upper border of the thyroid cartilage and empties into the lymphatic glands which lie on each side of the larynx. The second trunk is made by the union of all the lymphatic vessels distributed to the mucous membrane below the epiglottis. This lower trunk emerges below the border of the cricoid cartilage and empties into the lymphatic glands on each side of the trachea. The distribution of lymphatics is much richer in the supra-glottic portion of the larynx than it is in the subglottic portion.

The *lymphatic tissue*, according to some observers, is found distributed at the border of the epiglottis and in the ary-epiglottic folds to the mucous membrane over the arytenoids, the cartilages of Santorini, and the posterior commissures. This lymphoid tissue distributed in these areas of the larynx has been named "the laryngeal tonsil."

The *physiology* of the larynx may be considered under the functions of *respiration* and *phonation*.

Respiration is carried on through the laryngeal aperture, or rima glottidis, by means of inspiratory and expiratory currents of air. The inspiratory effort is not a passive movement like the expiratory movement. During inspiration the rima glottidis is widely opened, and under *extra* inspiratory effort more widely opened. (Plate VII., Figs. 21 and 22.) This vocal aperture has been graphically named the "portal of the breath of life." The widening of the space between the vocal bands is accomplished by muscular assistance from the "glottis openers," the posterior crico-arytenoids. Without this active assistance the inspiratory effort would be labored and difficult, from impingement of the air-current against the projecting soft parts, especially against the vocal bands. Expiration is a much more passive movement than inspiration, being automatically carried on without the aid of the larynx. The current of air forced from the lungs is regulated by inspiratory muscles other than the larynx, the chief of which is the diaphragm. The reflex character of the respiratory movement is governed by the "respiratory centre," situated in the brain in the floor of the fourth ventricle. The impulse which excites the act of respiration may be dependent upon accumulation of carbonic acid gas, or, according to later views, upon the presence of deoxygenated blood passing through the respiratory centres in the medulla.

The *phonatory* function of the larynx consists in the ability of the free edge of the vocal bands to be set in motion. This is accomplished through the expiratory blast, the direct converse of the action in respiration. This tone-production in the larynx is remarkable for its simplicity of mechanism. (Plate VII., Fig. 23.) The regulated approximation or adduction of the vocal bands so that the space between them is practically obliterated by the action of the arytenoid and lateral crico-arytenoid muscles enables the column of air from the lungs to impinge against the free edge of the vocal bands and set them in motion. The volume and velocity of the current of air are so delicately regulated by the various laryngeal muscles as well

as by the diaphragm and chest muscles that the blast is automatically controlled in all the various and complex movements demanded in the speaking and singing voice. This movement of the free edge of the vocal bands in phonation produces sonorous vibrations which set in motion the columns of air in the pharynx. The vibrations are greatly amplified and perfectly modified by the shape of the cavities and adjustment of the soft parts in the pharynx, mouth, and nasal cavities. In this manner articulate speech is produced by the aid of the mouth, tongue, teeth, and lips. In the regulation of the adduction of the vocal bands other vocal muscles than the arytenoid and lateral crico-arytenoids are required to control the tension of the vocal bands.

The tension is *chiefly* regulated, indeed, by the action of the crico-thyroid and thyro-arytenoid muscles. The demands of tension and relaxation are greatly increased in the musical scale, and the singing voice in its perfection and its delicate and charming amplification is dependent upon a complete and harmonious development of those muscles. The *inner* fasciculi of the thyro-arytenoid muscles are chiefly concerned in fixing the free edge of the vocal bands in a state of rigidity. The free edges of the band need not be parallel, but may be slightly curved, so as to show an elliptical slit under certain vocal efforts. The stretching and rigidity of the vocal bands render them capable of increased vibratory movement, and when in this condition the expiratory blast produces a much higher tone, recognized as *pitch*. This tension and fixation are produced by the action of the crico-thyroid and thyro-arytenoid muscles, with the assistance of the arytenoid and lateral crico-arytenoid muscles, which fix and steady the arytenoid cartilages on their bases. The epiglottis was formerly held to occupy an important place in phonation, but at present its movements are believed to depend upon the movements of the larynx, the epiglottis being raised or depressed with the corresponding movements on the part of the larynx. It has also been considered as a resonator to the vocal waves. These attributed functions of the epiglottis in phonation are still a matter of opinion: its acknowledged functions are closing the laryngeal aperture during the act of swallowing, and directing the secretions from below to the oral cavity. The ventricles of the larynx have been considered by some as additional resonators to the voice, from the fact that certain animals capable of loud cries have largely-developed ventricles. Bosworth suggests in opposition to this that in the larynges of lions and tigers—animals of especially loud voice—no ventricles are found.

The characteristics of the voice are pitch, intensity, and quality. The *pitch* of the voice is dependent upon the number of vibrations in the vocal bands. The *intensity* of the voice is dependent upon the amount of expiratory effort used in driving the air through the rima glottidis. The *quality* or *timbre* of the voice is its individual character, and is dependent upon the anatomical features of each individual larynx, pharynx, and nasal and accessory cavities.

Articulate speech is composed of an aggregation and modification of elementary sounds produced in the larynx. The larynx primarily produces only *vowel* sounds; the consonants are formed by the expiratory blast in the throat, mouth, and nasal cavity. The *consonants* are produced by the interruption of the expiratory blast by the various changes of the soft parts in the oral cavity, and by the position of the lips. Certain sounds in which the expiratory blast is suddenly interrupted are called explosives; in aspirates the air passes through a constriction in the mouth which may be formed by the lips or by the apposition or pressure of the tongue against the palate. In the forming of resonants the vibrations are chiefly directed into the nasal chambers, the palate being relaxed and the naso-pharyngeal space being kept widely opened. A whispering voice is produced when the anterior portions of the vocal bands are approximated while posteriorly they are open. These vibrations are converted into articulate speech by the tongue, lips, and teeth.

The singing voice demands of the larynx its highest efforts. By the singing voice is meant the production in the larynx of the successive tones of the musical scale. The singing voice is the same in men and in women: women, however, in singing the same score take a note an octave higher than men. In childhood there is no difference. The individual differences in pitch in men's voices are designated as tenor, baritone, and bass; while the corresponding differences in women's voices are called respectively soprano, mezzo-soprano, and contralto. The average singing voice has a range of about two octaves. The mechanism is the same in the production of musical tone in men and in women. The registers of the singing voice are known as chest, middle, and head, according as they are produced from the chest, the oral cavity, or the cavities of the head. They are also described as thick, thin, and small. The thick or chest register belongs to the male voice and to the contralto in the female, and is the one to which the conversational voice of men belongs. In the production of the lowest notes in the register the larynx is in a fixed position, the arytenoid cartilages are in apposition, and the rima glottidis becomes an elliptical opening. In the production of the highest notes in the register the posterior portions of the vocal bands are in apposition. This contact is gradually increased as the higher notes are produced. While in the lower register of the singing voice the entire thickness of the vocal band is brought into play in the vibratory movement, in a high or head register the vocal band is thinned and the free edge alone appears to be concerned in the vibratory movement. It is beyond the scope of this article to enter into a consideration of the more intricate and finer points concerned in the production of the singing voice. Full discussion of the subject may be found in scientific treatises on the mechanism of the singing voice.

VOCAL CULTURE AND HYGIENE.

BY S. HARTWELL CHAPMAN, A.M., M.D.,

Member of the American Laryngological Association; formerly Lecturer on Laryngology and Otology in Yale College, etc., etc., New Haven, Conn.

THE cultivation of the voice in speech and song has been an essential part of the mental growth of all races. Darwin has been led to believe that the progenitors of the human race employed musical sounds before they had acquired the power of articulate speech, and that in consequence of this the voice when employed in any violent emotional excitement always tends to assume a musical character, on the principle of association.

In the ruder civilizations of the early Chinese dynasties and the Indian races this cultivation was confined to the priesthood, but with the advancing centuries toward the Christian era the voice became more and more a power for stirring the passions of men, and for controlling the masses, and for that reason was treated with the consideration which was its due. As may be justly inferred, the voice in speech received the greater attention, and attained a high degree of perfection hundreds of years before the singing voice was considered worthy of special study.

In ancient Greece the study of the voice in speech kept pace with the wonderful development in literature, and to such an extent that three classes of teachers were employed for this purpose, the *phonascei*, the *vocales*, and the *vociferarii*.¹

In the construction of the Greek drama, as, for example, the "Antigone" of Sophocles, we obtain the first evidence of the growing importance of the voice in singing, for the chorus of the Greek play takes no mean or secondary part in its dramatic action.

Still, it must be admitted that the invention of the modern scale in music gave the first great impulse toward vocal cultivation, which has since reached such a condition of perfection. The musical scales of the Greeks were built on a system of *tetrachords*, or groups of four notes ascending in diatonic succession, and it is believed were derived from the knowledge of the music of the Egyptians, who, as evidenced by their monumental remains, had already attained considerable proficiency in the art.²

Harmony, in the meaning of the modern term, was probably unknown,

¹ "Philosophy of Voice and Speech," by James Hunt, London, 1858.

² History of Music, Hunt, 1878.

although Terpander of Lesbos (B.C. 670) invented a seven-stringed kithara. But while there is no evidence that the Egyptians enjoyed other than instrumental music, the Greeks employed instruments only as an accompaniment to the voice, in both chorus and monologue.

Tyrtæus (B.C. 685) was the first of the troubadours. It was not, however, until the middle of the fourth century that the first singing-school was instituted by Pope Sylvester. From this time there was a constant but slow progress toward the present perfection in musical science.

Owing to the crude forms and sound-imperfections of musical instruments, vocal music received for the first twelve centuries by far the greater attention. The majority of the musicians of this era were singers of reputation: St. Ambrose, the author of the "Te Deum" and of the four diatonic scales, known as "The Authentic Modes;" St. Gregory, the author of the "Antiphonar," a collection of antiphons, or chants sung alternately by priests and choir; Isidore of Seville, the author of the first "Treatise on Music," establishing the evidence of the first conceptions of harmony; Hucbald, who accompanied his own songs by a discantus of consecutive fourths or fifths; Guido of Arezzo, called the "Inventor Musicæ," who added two extra lines to the staff, distinguished by different colors, and was the author of "solmization." Guido invented the terms *ut, re, mi, fa, sol, la*, which are even now used. They were derived from the following melody,¹ so arranged that each line began with the note it was employed to indicate:

*Ut queant laxis
Resonare fibris,
Mira gestorum
Famuli tuorum,
Solve polluti
Labbii reatum,
Sancte Johannes.*

Franco of Cologne (*circa* A.D. 1050) was the father of the present musical time and measure, inventing the figures which denote the maxima, longa, brevis, and demi-brevis. Adam de la Hale (A.D. 1230–1250) was a famous troubadour, being the author of many three-part songs, similar to the Volkslieder of early Germany. During these centuries the perfecting of instruments had been progressing.

So early as 950 A.D. an organ of four hundred pipes was in use in Winchester Cathedral. Violins, violas, and cellos reached their perfection in the fourteenth century. With the influence of Bach's surprising genius the ascendancy of the voice began to wane, and the struggle between vocal and instrumental music afterwards went on with varying success, until Wagner, the great master of instrumental music, succeeded in relegating the voice to the secondary position.

As a preliminary to the discussion of the physiology of the human

¹ History of Music, Hunt, 1878.

voice, and the relation of the laws governing its development, it may be well to decide certain important questions relating to the subject. And first: What is the essential faculty in voice-cultivation? I say, without hesitation, a good musical ear. The ear is master of the voice. Whatever the ear commands of the voice, the voice endeavors to do. If the ear be tone-blind, the voice, although of surpassing richness and power, is incapable of producing consecutive and correct musical tones.

Semon¹ writes as follows: "There are almost as many different senses in which the expression 'musical ear' may be taken as there are with regard to the expression 'musical' in general. It is perfectly well known that whilst in some persons the musical ear is, by a generous gift of nature, even if entirely untutored, yet endowed with the keenest qualities of perception, of action based upon that perception, other people, equally intelligent, are entirely deprived of any natural endowment in this particular direction, and have, as the saying goes, absolutely 'no ear for music.' Now, this may mean a great many different things. Some people have no ear for pitch, others none for melody. The former will not hear even the most abominable flat or sharp singing; the latter will never recognize even the most catching melodies, however often they may have heard them.

"Upon the tympana of others music makes a directly painful impression. A third class has absolutely no sense of rhythm, and cannot distinguish a march from a waltz; again, others,—and here we come to the subject now under consideration,—though having a keen enough perception of music, and being ready enough to detect faults in others, are utterly unaware either of the quality or of the pitch of their own voices."

The perfect sense of hearing is so dependent upon accidental or temporary conditions as to be at times unreliable. Who has not heard celebrated vocalists singing false? The writer was told by a distinguished prima donna that certain drugs played a curious trick with her sense of hearing, in that, under their influence, she always sang a particular note a semitone too high. And yet of this fact she herself was quite unconscious: she sang the tone as she heard it.

This sense is not of such great importance to the speaker as to the singer, for it is the matter, not the manner, of the speaker which an audience desires. Yet of two speakers equally brilliant in mind, the one possessing the musical sense sways his audience far the more and speaks with much the greater ease; and, however severe may be the training, the other will never be able to acquire the sympathetic tone.

"There is a beautiful as well as an ugly vocal tone. Beautiful sound is the natural result of true adjustment of an instrument over which the orator or singer has absolute control, while ugly sound is but a crippled result of solely a partial control."²

¹ Semon, *Culture of the Singing Voice*, March, 1891.

² Lunn, *Philosophy of Voice*, p. 59.

The second essential to vocal culture is the possession of a good vocal instrument or larynx. Leaving out of consideration congenital defects and pathological conditions of the larynx, we can safely say that the larynx of every human being is capable of emitting sound of some sort.

The disparity between vocal organs is, however, great. Of two uncultivated organs, to laryngoscopic examination apparently alike, the one may be capable of giving three or four tones only, while the other may possess quadruple this vocal range.

While it is conceded that every normal larynx is capable of some improvement in its range and strength of singing tone, and, for this reason, vocal culture is strongly advocated, yet it is equally true that only the few reach that higher condition of development which makes them renowned as singers. As well expect the tones of a cheap-jack violin ever to equal the grand music of a Straduarious.

I do not intend by these remarks, however, to imply that those only who possess large and beautiful material should devote themselves to the art of singing. Many voices naturally weak are still so capable of intelligent training as to become a source of pleasure to those who hear them; and as it is often found that the sympathetic timbre is coupled with certain deficiencies of development in other directions, the training of such voices is strongly advocated. The essential point is to discover what each is capable of, and then to train and use the voice in an intelligent manner within its enforced limits.

The question of the distribution of singing is an interesting one, and capable of reasonable solution. Like the noble violins and cellos of the Middle Ages, the first singing voices came from Italy. The majority of the best singing voices come from Italy still. Why is this?

It cannot be the result of climate. The air of other countries whose shores are lapped by the blue waves of the Mediterranean is seldom stirred by song. It cannot be a peculiarity of race alone, for the Italian is own cousin of the Frank and the Spaniard. But it is a development through centuries of a cultivated and sensitive ear, passionately eager for melody, and dominating the voice. It is also due to the character of the Italian language, which, being largely composed of vowels, demands a full and free utterance. It is due also to the Italian method of singing, which is founded upon the language of that country. This solution of the question will account for the German races taking but second place, and for the almost total absence of the art of song among the darker regions of the North and the countries lying under the equator.

In studying the physiology of the voice let us first examine the acoustics of the subject. Musical sound is the result of rhythmical rapid vibrations of some medium, no matter what this medium may be: the sands of the sea, or the shells lying strewn upon them; the gleaming grain of the meadow, or the song-pipes of the larks soaring high above it.

Vibrations may extend uniformly to the entire medium, or there may

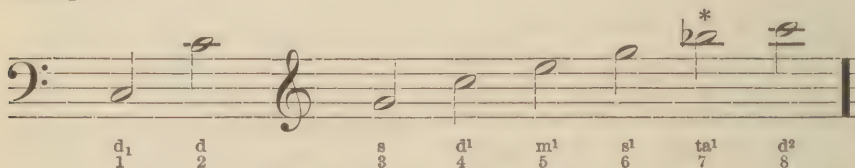
be several sets of vibrations in the same medium. In the former case they are called *simple*, and give rise to *simple tones*; in the latter case they are multiple or *compound* vibrations, giving rise to *compound tones*.

The loudness of the tone depends on the strength of the blow producing the tone, the distance at which the tone is heard, and the density of the air in which the vibrations take place.

The pitch depends solely on the rate of vibration. The human ear is incapable of recognizing as tones vibrations below sixteen and above thirty-eight thousand per second, while the vibrations between forty and four thousand are ordinarily alone pleasing to the ear, and may be therefore called musical tones. The greatest range of vibrations producing musical tones in the human voice is probably between fifty and eighteen hundred, although Bastardella is said to have had a range between forty-four and nineteen hundred and eighty.¹

In the study of the singing voice we have to do only with compound tones, although it is probably true that the human voice is capable of producing single tones at times, under the stress of great emotion. These compound tones are the result of the reflection of the single or prime tone against the various resonators of the passages in and from the larynx, producing thereby fainter secondary or partial tones.

These compound tones are therefore composed of the prime or initial tone and of several secondary or partial tones. Thus, the tone C may be composed of the prime tone and of seven partials, and is never composed of fewer than three or four upper partials in addition to its prime tone; for example:



* Slightly below the pitch here indicated.

It is upon this combination of tones that *quality* depends. Helmholtz asserts² that prime tones possessing the same force and pitch sound exactly alike, no matter from what instrument or medium they arise.

The distinguishable difference, therefore, between the tones of the violin and cello is dependent not on the prime tones, but on the combination of upper partials. For the same reason it may be considered that the variability in the richness or sympathetic quality of vocal tones is due largely to the variable number of upper partials added to but not overwhelming the original tone.

¹ Voice, Song, and Speech, Browne and Behnke, p. 18.

² Sensations of Tone, Helmholtz, translation by Ellis.

THE PHYSIOLOGY OF THE VOICE.

The human voice is the result of the combined action of a certain *force* with and upon a certain set of organs called the vocal organs. In a description of this subject we can therefore divide it into—

- a. The motive power ;
- b. The organ of sound ;
- c. The organs of resonance.

The readers of this article are already sufficiently acquainted with the anatomy of the human body. It is my purpose, therefore, to describe only what seems necessary to the understanding of the development of different tones. As my readers can also refer to many works on anatomy which are no doubt at hand, it will be unnecessary to insert many explanatory anatomical plates.

The motive power consists of the air forced out of the lungs through the trachea by the combined action of chest-muscles and diaphragm. During the ordinary acts of inspiration and expiration we are well aware of the absence of apparent effort. Several such acts are necessary to change completely the air in the lungs. In natural inspiration the diaphragm partially descends, the chest-walls are raised and widened in a measure by the action of the pectoral muscles, and the elastic tissue of the lung is distended by the air rushing in through the glottis to fill the vacuum so produced. In natural expiration, muscles, elastic lung-tissue, and chest-walls simply return to a state of rest. But for the purposes of vocalization all these movements are, however, intensified. In inspiration the diaphragm is fully flattened and the chest-muscles enlarge the chest-box to its fullest capacity ; the lungs then are made to contain their maximum amount of air. Now takes place the first act in vocalization, the closure of the glottis. This produces an impediment to the free escape of air, a *vis a fronte* which is just equal to the expulsive force of the contractile lung-tissue. To overcome the counterpoise so produced, the diaphragm and chest-muscles are then called upon to expel the air from the lungs. In doing this the diaphragm finishes its work first. In a later section this will be more fully explained. The organ of sound is the larynx, or, as some writers are pleased to call it, the "voice-box." The larynx is a hollow organ something like a reed, composed of nine cartilages held in correct adjustment by elastic ligaments and fibrous tissue, also of two strong fibro-muscular bands, the chordæ vocales, all these covered by mucous membrane of a particularly delicate and destructible character, and fixed in the processes of breathing and vocalization in very many but minutely differing positions by the complicated co-ordinating action of more than eighty different muscles.

What wonder, then, that writers are at variance with regard to the action and conditions producing definite tones? All are agreed that the chordæ vocales, like the strings of a violin set in motion by the bow, are made to vibrate by the force of the expelled or inspired air, and in this way

to produce sound. But that it is possible for two ribbons hardly an inch long to produce tones ranging through two and one-half to three octaves is a matter of discussion and diverse explanation. The opinion of Lunn and Garrett, that the male larynx differs in no way anatomically from the female except in size, is not verified by the more careful dissections of Luschka,¹ who gives the average variance as following:

	Male.	Female.
Length anteriorly	7 centimetres.	4.8 centimetres.
Greatest width within thyroid cartilage.	4 "	3.5 "
Height of thyro-ericoïd space	3 "	2.4 "
Length of rima glottidis	25 millimetres.	15 millimetres.

We see from these measurements that the male larynx is nearly twice as long as, and yet very little wider than, the female, and that the rima glottidis is one-third longer in the male than in the female larynx. The natural position of the larynx in the male is also on a plane considerably lower than the larynx of the female. This disparity in shape, size, and position accounts for the well-known fact that the male voice possesses more upper partials than the female, a good bass voice having as many as twenty, while the female is well equipped with ten. To counterbalance this disparity in wealth of upper partials, the male voice possesses but two registers, while the female voice is composed of three and sometimes even of four registers. What are the causes which produce the various classes of voices, basses, contraltos, tenors, and sopranos?

The first principle involved, and agreed upon by Behnke, Lunn, Luschka, Howard, and others, is that there is, speaking only of the normal larynx, a counterbalance between the chordæ vocales and the crico-thyroidei muscles; that is, the lighter, thinner, and narrower the bands the stronger in proportion are the crico-thyroidei muscles. Ordinarily the vocal cords of the bass and contralto are longer than the average length of mezzo-soprano or soprano cords, but, owing to the capability of greater extension by reason of the greater power of the crico-thyroidei, the tones produced are of much greater range. The second principle involved is that the kind of voice depends upon the length of the voice-box; the third, that it depends upon the distance between the vocal cords and the superior resonators, namely, the pharynx and mouth. These two principles are well illustrated by Professor Tyndall's clever experiment, in describing which we quote his words:² "The simplest illustration of the action of a reed commanded by its aerial column is furnished by a common wheaten straw. At about an inch from a knot I bury my penknife in this straw to a depth of one-fourth of the straw's diameter, and, turning it flat, pass it upward toward the knot, thus raising a strip of the straw nearly an inch in length. This strip is to be our reed, and the straw itself is to be our pipe. It is now eight inches long; when blown into, it emits a decidedly musical sound. I now cut it

¹ Der Kehlkopf des Menschen, 1871.

² Tyndall on Sound, p. 194.

so as to make its length six inches: the pitch is higher. With a length of four inches the pitch is still higher. I make it two inches, and the sound is very shrill indeed. In all these experiments we have the same reed, which was compelled to accommodate itself throughout to the requirements of the vibrating column of air."

The fourth principle involved is that the size and weight of the chordæ vocales determine, in a measure, the kind of voice produced. The fifth principle is that there must be a certain proportion in size between the cords on the one hand and the voice-box and organs of resonance and reflection on the other. While we cannot agree with Ferrein in comparing the voice-producing mechanism so exactly to the violin, or, with the other writers, Semon, Lunn, Behnke, and Tyndall, to the pipe, still the partial resemblance in action to both is so great that we may well illustrate it by them. The resemblance to the organ-pipe extends especially to the conduct of the vocal cords. It is impossible for the most expert singer to move one cord without the other. The same nerves control both, so that the action of one cord is identical with the action of the other.

Upon the question of nerve-supply and the symmetrical action of the cord let me quote from Felix Semon's admirable sketch, previously mentioned: "The respiratory as well as the phonatory muscles of the larynx receive their nerve-supply from two small nerves, the superior laryngeal and the recurrent laryngeal.

"The superior laryngeal only supplies the tensors of the vocal cords, the crico-thyroid muscles, with motor fibres, whilst the recurrent is distributed to the adductor as well as to the abductor muscles. It is still an open question whether the recurrent is ultimately derived from the spinal accessory or the vagus nerve, both being cranial nerves the centres of which are situated in the medulla oblongata. The researches of Ferrier, Duret, Münk, Krause, Horsley, and myself have shown that the medulla is not the ultimate seat from which impulses are distributed along the motor paths just sketched to the laryngeal muscles, but that there is for the purposive function which the larynx serves—viz., for phonation—a distinct centre in the surface or cortex of the brain, situated in the foot of the ascending frontal gyrus, just behind the lower end of the precentral sulcus. It is a very interesting and noteworthy phenomenon that Professor Horsley and I have only been able to find (except in the cat) a definite area of representation of the action of the vocal cords in the cortex of the brain for the intentional purposive movements of the vocal cords, such as are used in speaking and singing. On stimulation of the area on one side both vocal cords directly come together (that is, are adducted), and remain so long as the stimulation lasts in the position which they assume when used for either of the last-named purposes.

"It is never possible, according to our researches, to produce an action of one cord alone: they always act bilaterally and symmetrically. Tension and adduction occur absolutely simultaneously, or at least our retina is not

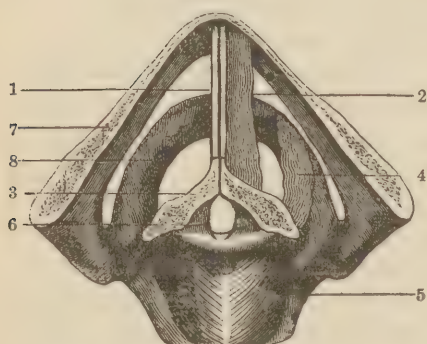
able to distinguish any point of time between the execution of these two movements."

The larynx resembles still further the organ-pipe in its conformation, since it consists of the trachea joining it from below, and the pharynx, palate, and mouth above. But here the resemblance ceases. The organ-pipe possesses but a single tone, while the larynx is capable of giving from two to three octaves of tones. This reduplication of tones must be due to conscious cerebration acting upon the thyro-arytenoid muscles through either the superior or the inferior laryngeal nerve. These muscles, afterward described, may be considered the fingers of the left hand, which are made to perform difficult individual and quite separate movements in the control of the strings of the violin. The training of the fingers is due to conscious cerebration, assisted by the senses of both hearing and sight. The training of the thyro-arytenoid muscles is due to conscious cerebration, assisted only by the sense of hearing. How marvellously delicate and complex must be the action of a muscle which is capable, whether assisted by others or not, of producing out of a single cord barely an inch long treble the number of tones of the individual strings of the violin!

In discussing the question of production of the human voice we may divide the subject into—1, the mechanism of sound; 2, the mechanism of tone.

Sound is the result of the vibration of the cords, held in vibratory position by the involuntary action of certain definite muscles of the larynx.

FIG. 1.



1. Vocal cords in phonative position; 2, thyro-arytenoid muscle; 3, section of arytenoid cartilage; 4, crico-arytenoid muscle; 5, crico-arytenoid posticus muscle; 6, crico-arytenoid ligament; 7, thyroid cartilage; 8, cricoid cartilage.

Tone is the result of this action controlled by the will. The accompanying illustration demonstrates the simple act of emitting sound (Fig. 1).

The adductors—the crico-arytenoidei laterales and the arytenoideus—turn the arytenoid cartilages upon their articulations, carrying with them the posterior insertions of the vocal bands, until these bands are closely approximated and are nearly parallel. The cords are now in vocalizing position. The action of these three muscles is quite as much an involuntary one as the action of the abductors, and the vibration of

the cords in this the natural position decides the pitch of the prime tone. This prime tone, with a few added reverberations caused by the prime tone passing over the organs of resonance, may be produced at any moment by a moderate and often involuntary increase in the action of the motive power, the muscles of the chest. This is well illustrated by the sound emitted during spasmodic action of the chest-muscles, called coughing, and which may be produced at any time by artificial irritation of the pharynx.

An acquaintance may be recognized by his peculiar cough, as well as by his voice, once having been heard. The sound produced by the simplest and most natural vibrations of the cords cannot be distinguished from a sound of the same pitch produced by whatever sort of musical medium, but the added quality which enables us to distinguish the sounds of the violin from those of a cornet and of reed-instruments from the human voice is obtained from the reverberation of the original sound through the cavities called the resonators, these echoes of the original being the upper partials, of which we have spoken.

The *muscles* and *cartilages* through whose agency these phenomena take place are the following. The thyroid and cricoid cartilages need no extended description. It is only necessary to remark that the use of these cartilages is, first, to form the pipe in which the reed-instrument, the vocal cords, is placed, and, second, by the rocking of the former upon the latter to place the cords in the correct phonative position. This will be seen by a study of the *crico-thyroid muscles*. Each muscle arises from the lower border of the thyroid cartilages, descends obliquely inward, and is inserted in the side of the cricoid cartilage. Its purpose is to approximate the anterior portions of these two cartilages, and thus to tighten, by lengthening, the vocal cords. It was formerly supposed that this action occurred by the sinking of the posterior half of the thyroid cartilage (Holden, Huxley), but it is well demonstrated by Morell Mackenzie, Hooper, and Lunn that the cricoid, inferior in weight and size as well as in position, is made to approach the thyroid.

An important and practical result of this is well defined by Lunn,¹ whom I quote as follows: "As the larynx ascends, the speed of ascent of the cricoid is swifter than that of the thyroid, so that the cricoid in its ascent gains upon its auxiliary, hence the vocal cords are tightened and the pitch of voice raised.

"In this ascent the thyroid and cricoid rotate upon an eccentric centre, causing the planes of both false and true cords to become with each heightened tone more slanting; thus the sound, travelling at a right angle to these planes, finds its point of contact more and more forward on the arch of the palate with each ascending tone."

In the following illustration the arytenoid cartilage, in assuming a position in a higher plane, moves farther away from the anterior angle of the thyroid and stretches the vocal cords, the fullest extent of motion of both cords and cartilages being barely half an inch. This can easily be verified by experiment upon one's own throat. Place the tip of a finger in the slight depression called the crico-thyroid space, and sing a few notes of the ascending scale. You will observe that while the entire larynx slightly ascends in the neck, the depression in which you have placed your finger grows smaller and smaller, until the finger-tip is quite pushed

¹ *Philosophy of Voice*, p. 86.

out by the ascending cricoid, and the borders of the two cartilages can be felt in juxtaposition.

The stretching of the cords is attended by another phenomenon, of the utmost importance. While the insertions of the cords in the angle of the thyroid cartilage remain practically in a fixed position, the arytenoideal insertions rise with the approximation of the two great cartilages (see Fig. 2).

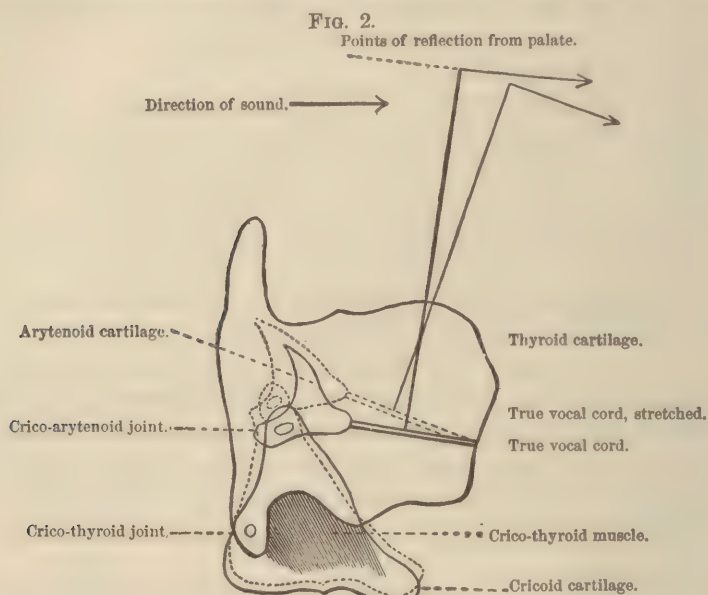


Diagram showing action of crico-thyroid muscle, stretching of the vocal cords, and altered direction of sound.

The vibrations of the vocal cords escape at right angles to the plane of the cords; hence the higher the posterior insertions the more are the cords tilted forward, and consequently the vibrations impinge on the reflecting surfaces above more and more anteriorly.

A detailed description of the opening muscles, the *abductores crico-arytenoidei postici*, is not necessary, since they have no direct action in producing voice. There are two pairs and one single muscle whose co-ordinating movements are directly involved in the production of sound, and whose action should be thoroughly understood. They consist of the *arytenoideus*, the *crico-arytenoidei laterales*, and the *thyro-arytenoidei*.

In the following figure these important muscles are represented by 8, 15, 16, 17, 18. The principal office of the *arytenoideus* is to neutralize the opening action of the *crico-arytenoidei postici*. These latter involuntary muscles are of the greatest importance to life, since their action opens the glottis, to offset and counterbalance which we possess the voluntary muscle the *arytenoideus*.

The first act in producing sound, then, is a condition of equilibrium, reached through this counterbalancing of the muscular action just described.

The second act is brought about by the intervention of the crico-arytenoidei laterales, whose duty is, by contracting, to turn the arytenoid cartilages upon their pivots until the vocal cords lie parallel. This action is supplemented by a second, namely, that of fixing firmly the cartilages in this position by continuing in a state of contraction during the continuance of the vibrations of the cords. We now have as complete a combination of muscular action as is necessary to make the chordæ vocales vibrate, with sound as a result. The great importance of the remaining pair of muscles will be apparent when we realize that the thyro-arytenoidei are the developers of tone. We can illustrate this by referring again to the management of the violin.

The duty of the crico-thyroid is purely mechanical, and may be likened to the stringing of the violin, the insertions of the muscles representing the violin-pegs: the more taut the string the higher the tone. But the action of the thyro-arytenoidei may be likened to the control of the finger over that string: with every alteration of the point of compression by the finger a new tone is evolved.

"This muscle arises from the angle of the thyroid cartilage, runs horizontally backward, and is inserted into the front surface of the base of the arytenoid. Its fibres run parallel with the vocal cord, and some of them are directly inserted into it. Part of the muscle spreads out so as to form a floor for the ventricle of the larynx, and is inserted into the outer border of the arytenoid cartilage."¹

For a just understanding of the action of the thyro-arytenoid muscle upon the adjacent cord we must study for a moment the formation of the cord itself. The cord is composed of bundles of thin elastic tissue, united into one at its insertion into the angle of the thyroid cartilage. A short distance from this insertion the elastic band is strengthened by fibro-elastic tissue, forming a small nodule which is sometimes designated "the sesamoid cartilage." At this point the single elastic bundle is divided into several, separated by connective tissue and spread out independently of one another to find their insertions in the middle and posterior thirds of the thyro-arytenoid muscle, in the apex, posterior surface, and base of the arytenoid cartilage, in the crico-thyroid ligament, and in the inferior horn of the thyroid cartilage.² Separated by connective tissue as these several strong elastic bundles are, and having their *point d'appui* so far apart, they are

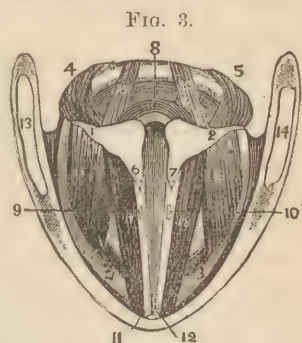


FIG. 3.
1, 2, Processes of arytenoid cartilages; 3, cricoid cartilage; 4-1, 5-2, m. crico-arytenoidei postici; 6, 7, vocal processes of arytenoid; 6-11, 7-12, chordæ vocales; 8, m. arytenoideus; 9, 10, Elsberg's "vocal nodules;" 11, 12, sesamoid cartilages; 13, 14, thyroid cartilages; 15, 16, m. crico-arytenoidei laterales; 17, 18, m. thyro-arytenoidei; 19, 20, elastic ligament.

¹ Holden, p. 147.

² Stricker, Gewebe-Lehre, p. 460.

capable not only of collective and uniform but also of independent and quite separate action. From what has been said it will readily be seen that the vocal cord is a complex band made up of many quite distinct strands, which are put in motion either together or separately by the thyro-arytenoid muscle.

It has been further discovered that these points of insertion are not absolutely in the same position in all tone-organs. On this account we are capable of showing that while the tone in two different voices may be the same, the position of the cords and general appearance of the laryngoscopic image may materially differ. The laryngoscope has been much employed in the production of tones. Some writers hold that in the laryngoscopic position and with the mirror *in situ* the conditions are so altered that the larynx is unable to exhibit its true and natural reflections.

This can be true only of the highest notes of the soprano and tenore robusto, during the rendering of which all the various muscles of chest, neck, and throat are at extreme muscular tension. It is possible, therefore, to illustrate the theoretic changes in the laryngeal image during the rendering of different notes by means of the accompanying illustrations.

FIG. 4.



FIG. 5.



FIG. 6.




Behnke¹ says, after defining "register" as consisting of a series of tones produced by the same mechanism, that there are, broadly speaking, three registers in the human voice, the mechanism of which is plainly visible, namely : 1. During the lowest series of tones the cords vibrate in their entire thickness (see Fig. 4) ; 2. During the second or middle series of tones the cords vibrate only with their inner edges (see Fig. 5) ; 3. During the highest series of tones a portion of the vocal chink is firmly closed, and only a small part vibrates (see Fig. 6).

Madame Seiler,² whose experiments with Du Bois-Reymond entitle her to credit, graphically explains this as follows : "When, in using the laryngoscope upon myself, I slowly sang the ascending scale, this movement of the vocal ligaments was repeated at every trial. They separated and appeared to retreat, in order to close again anew and to rise somewhat more than before. With every higher tone the cords seemed more stretched and the vocal chink somewhat shorter ; when I sang the scale upward, beginning with the lowest tones, the cords seemed to be moved in their entire length and breadth by large, loose vibrations.

¹ Mechanism of the Human Voice, p. 86.

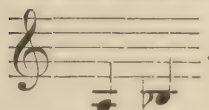
² The Human Voice in Singing, 1875.

"The place at which the pyramids, almost closed together, cease their action and leave the formation of the sound to the vocal ligaments alone, I

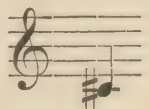
found in the thick register of the female voice at C, C#  ;

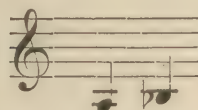
more rarely at B .

"In the thick register of the male voice this change occurs at A,


Bb  . With some effort the above-mentioned action of the

pyramids may be continued several tones higher, but such tones, especially in the female voice, have that rough and common timbre which we are too often compelled to hear in our female singers. The glottis also, in this case, as well as the parts of the voice-box near the glottis, betrays the effort very plainly ; as the tones ascend the glottis and the surrounding parts grow more and more red. As at this place in the thick register there occurs a visible and sensible straining of the organs, so also is it in all the remaining transitions as soon as the attempt is made to extend the action by which the lower tones are formed beyond the given limits of the same. These transitions, which cannot be extended without effort, coincide perfectly with the places where J. Müller had to *stretch* the ligaments of his exsected voice-box so powerfully in order to reach the succeeding half-tone. Garcia likewise finds tones thus formed disagreeable and imperfect in sound.

"Usually, therefore, at the note C#  in the female voice,

and A, Bb  in the male voice, the vocal ligaments alone

act in forming the sound, and are throughout the register moved by large, loose, full vibrations. But the instant the vocal ligaments are deprived of the assistance of the pyramids they relax and appear longer than at the last tone produced by that aid. But with every higher tone they appear again

to be stretched shorter and more powerfully up to F, F# .

the natural transition from the thick to the thin register, as well in the *male* as in the *female*. The voice-box is perceptibly lower in all the tones of the thick register than in quiet breathing."

Our next business will be to ascertain how these registers are divided among various voices.

The break¹ between the thick and thin or lower and middle registers

occurs in both sexes at about



. In order to realize the full

meaning of this the reader must bear in mind that music for tenors is generally written an octave higher than it is sung, so that the tones we are now speaking about would, as a rule, in a tenor part be expressed by



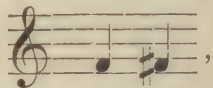
. My assertion, therefore, amounts to this, that everything



below , whether sung by soprano, contralto, tenor, or bass,

is produced by one mechanism, that is to say, by the vocal ligaments vibrating

in their entire thickness; and that the series of tones above



whether sung by bass, tenor, contralto, or soprano, is again produced by one mechanism (although a different one from the last); that is to say, by the vocal ligaments vibrating only with their thin inner edges. Then there remains the small register, which belongs almost exclusively to sopranos,

and which represents the series of tones above



I thus maintain not only that the great break between the thick and the thin occurs (individual differences apart) at the same place in both sexes, but that (leaving for the moment subdivisions out of consideration) the male voice has but two registers, *i. e.* the thick and the thin, while the female voice has three registers, *i. e.* the thick, the thin, and the small. From this it follows that the female voice is *not*, as supposed by some, simply a reproduction of the male an octave higher.


The registers of the male voice consist materially of two, namely, the chest and the falsetto,² while in the female organ three registers are clearly to be distinguished.



Dr. French believes that the female organ possesses ordinarily but three registers, whilst in exceptional cases it is composed of four. These registers are designated low, medium, and high by Merkel, for which terms thick, thin, and small are used by Behnke.

Notwithstanding this representative and apparently regular behavior of the vocal cords in producing the register, we should expect great variety in subdivisions of the regular registers as well as in their laryngoscopic images, owing to the fact previously mentioned, namely, that the insertions of the elastic bundles of the vocal cord vary much in location.

¹ Behnke, Teachings of the Laryngoscope.

² Der Kehlkopf, p. 153, 1873.

Behnke¹ recognizes this fact when he says, "We have so far only spoken of three registers, the thick, below , the thin, between

, and the small, above . The distinguishing

features of these are so very clear as to make any mistake impossible. But now we come to subdivisions, and with regard to these the matter is not so simple. Singers know very well that other breaks occur in the human voice besides those hitherto mentioned, and the question arises how they are to be accounted for by corresponding changes in the vocal organ."

For the same reason we cannot be certain of foretelling the quality and character of a voice from simply a laryngoscopic examination.

Semon² says, "The larynges of some of the greatest living singers look so commonplace that nobody, seeing one of these organs without knowing who its owner is, would ever venture for a moment to believe that this could be the organ to which he has been indebted for many a time of the highest artistic pleasure, whilst on the other hand magnificent-looking larynges are frequently found in the possession of individuals who not only are utterly unmusical, but at the same time incapable of producing anything like an average singing voice.

"Now, is it possible from the mere aspect of the larynx to say with absolute certainty even so much as what the general character of the singing voice produced by it may be? It is perfectly true that in the majority of cases soprani and tenors have, comparatively speaking, short and narrow vocal cords, while those of contralti and bassi are broad and long; but to this rule so many exceptions occur that anybody who trusts blindly to this sign will be exposed to very frequent mistakes."

We are, however, especially indebted to the admirable researches of Dr. French into the action of the glottis in singing³ for much valuable knowledge of the images produced in the larynx during the singing of the different notes of the registers. With his permission a number of illustrations are here produced, with explanation of them, as far as possible, in his own words:

"In the first photograph (Figs. 7, 8) the anterior boundary is rounded, and permits a view of the insertions of the vocal bands into the thyroid cartilage. The condition shown in the second photograph is present in most larynges during the production of the notes in the compass of the voice. In this larynx the extreme ends of the vocal bands are concealed

¹ Mechanism of the Human Voice.

² Culture of the Singing Voice, by Felix Semon, M.D., F.R.C.P., read at the Royal Institution of Great Britain, March 13, 1891, p. 6.

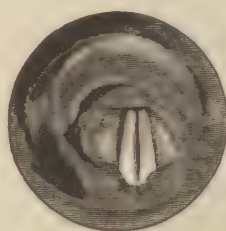
³ American Laryngological Association, 1886; Laryngological Section, Tenth International Medical Congress, Berlin, Aug., 1890.

from view by the lower boundary of the anterior wall of the larynx. It is only in the former class of subjects that the laryngeal image can be satisfactorily made.

FIG. 7.



FIG. 8.



“Occasionally the anterior insertions will show in only a portion of the scale. Such is the case in the person, of whose larynx the second of the first pair was taken, as will be seen in this group of three photographs. (See Figs. 9, 10, 11.) This group represents the larynx while singing the

FIG. 9.

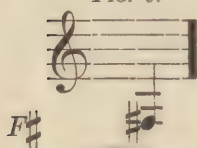


FIG. 10.

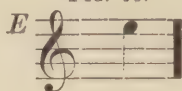
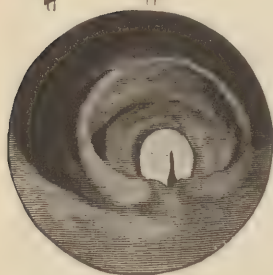
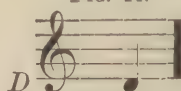


FIG. 11.



lowest, highest, and middle notes of the voice. In the lower and middle notes only are the anterior insertions exposed. In all the notes above they are covered, as before described.

“The second pair of photographs is the first of a series which I will show of the larynx of a well-known professional contralto singer. The voice is of excellent quality. The first pair was taken while F sharp, treble clef, third line below the staff, was being sung, and the second while she was singing E above.¹ These are one of the lowest and the highest notes of her lower register. In the photograph representing the lowest note it can be seen that the vocal bands are quite short and wide, and that with the exception of the anterior fourth the ligamentous and a part of the car-

¹ All notes in this and the following series were sung in the key of A.

tilaginous glottis is open and the slit between the bands is linear in shape. As the voice ascends the scale the vocal bands increase in length and decrease in width, until at the highest note of the register they can be seen to have

FIG. 12.

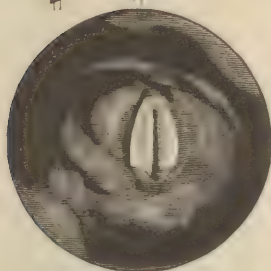
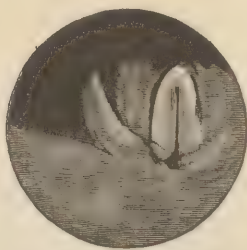
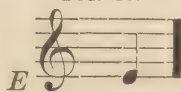


FIG. 13.



become considerably longer. It can also be observed that the ligamentous portion of the glottis is still open to the same relative extent, and that the cartilaginous portion has opened to its full extent. In the photograph representing the lower note the anterior faces of the arytenoid cartilages can be seen. As the voice ascended, the capitula Santorini were tilted forward. This seems to be proved by the change in the position of these structures, as seen in the photograph representing the upper note, as well as a similar change to be seen in nearly all the series showing the registers which I have taken. The epiglottis, though not well illuminated, seems to

FIG. 14.

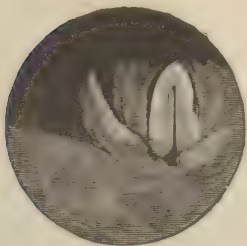
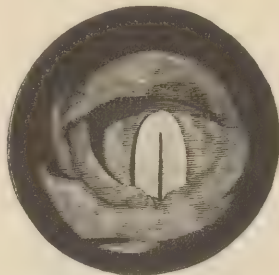


FIG. 15.



have risen as the voice ascended the scale.¹ The vocal bands have increased in length at least an eighth of an inch in seven notes. The compass of the voice of this subject is about two octaves and a half. Therefore, at that

¹ The light upon the epiglottis is so weak that the structure does not appear at all in the photo-engraving.

rate of lengthening, the vocal bands would increase nearly half an inch if their length was progressively increased while singing up the scale from the lowest to the highest note. This progressive increase in length does not, however, occur, and the reason will be apparent in the next pair of photographs (Figs. 14, 15), which show the changes which took place in the larynx at the lower break in the voice, which in this subject occurs at F sharp, treble clef, first space.

"The changes which occur at this point are extremely interesting and instructive. In the transition from the lower to the middle register, from E to F sharp, in the voice of this subject, the vibratory portions of the vocal bands are shortened about a sixteenth of an inch. The anterior insertions of the vocal bands can be seen in both photographs; therefore the actual difference in the length of the bands can be appreciated. The vocal bands have not only become shorter, but they appear to be subjected to a much higher degree of tension. The cartilaginous glottis is closed and the aperture in the ligamentous portion has been much reduced in size. The laws which govern the pitch in both string- and reed-instruments will aid us in explaining this change. Though the tone is higher and the degree of stretching less than in the note below, the tension is increased and the aperture through which the air passes is much narrower. It seems to me that this clearly-defined change in the mechanism of the vocal bands—which, so far as my investigations permit me to judge, are at this point in the scale the rule—will assist us to a clear understanding of the action of the laryngeal muscles in singing when we reach that part of the study.

"In the first photograph, which was taken while the subject was singing the note immediately preceding that on which the break occurred, the vocal bands can be seen to be long and wide and the posterior three-fourths of the chink of the glottis is open. By *open* I mean that the edges of the vocal bands are not in actual contact. The anterior fourth or fifth of the ligamentous portion of the glottis is closed. The space between the vocal bands is widest in the cartilaginous portion of the glottis. In the production of the next note higher (F sharp, the second of the pair) a marked change in the size of the larynx and in the length of the vocal bands is seen to have occurred. The cavity of the larynx has been suddenly reduced in size and the vocal bands have been shortened. The cartilaginous portion of the glottis is closed, and the ligamentous portion is open in a linear slit from the posterior vocal process to within a short distance of the anterior insertions of the vocal bands. The decrease in the length of the vibratory portions of the vocal bands is due to the closure of the cartilaginous glottis, for the ligamentous glottis remains about the same as in the note before the break. The arytenoid cartilages have been brought much closer together and occupy a more posterior position. These pictures were taken one after the other, in quick succession, the conditions in every respect, except the note sung, being the same. The antero-posterior and lateral dimensions of the cavity of the larynx are shown to have been considerably decreased

when the voice broke into the register above. When the mechanism of the larynx was changed the voice acquired a very different quality, which continued, in gradual elevation of pitch, throughout the register. As marked a change as this in the mechanism of the vocal bands in females is, I believe, only found in the larynges of contralto singers.

"As a singer ascends the scale above the break at F sharp, the vocal bands are increased in length and the chink gradually enlarges, as shown in Figs. 16, 17. The first photograph is of the larynx while singing F

FIG. 16.

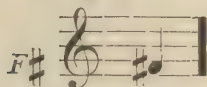
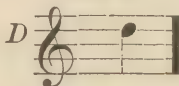


FIG. 17.



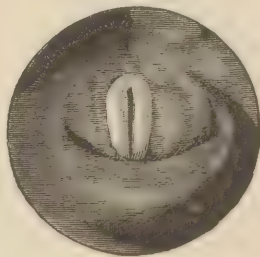
sharp, treble clef, first space, the note on which the lower break occurred, and the second while singing D, treble clef, fourth line, which is the highest note in the middle register of the voice of this singer. The difference in the length of the vocal bands and width of the chink of the glottis as the voice mounts from the lowest to the highest note of the middle register is clearly shown.

"Now the voice mounts one note higher—that is, to E, treble clef,

FIG. 18.



FIG. 19.



fourth space—and as it does so a distinct change in the mechanism of the vocal bands occurs. The changes which take place in the larynx at the upper break in the voice of this singer are shown in Figs. 18, 19. The

first of the pair represents the larynx while singing D, treble clef, fourth line, the note immediately preceding the break, and the second shows the change which occurred while singing E, the next note above. A very decided change in the mechanism of the vocal bands is apparent. These ligaments have grown shorter and narrower, and the chink, which in the note before the break can be seen to be linear in shape and quite wide, after the break becomes considerably reduced in both length and width.

"It may be remembered that in this larynx the vocal bands increased in length from the low F sharp to the E above. At the next note higher they began to increase in length again, until D above was reached, and at E, the next note above, they were again suddenly shortened. It will be instructive to determine the degree to which the vocal bands were lengthened and at what point in the scale they were longest. We saw that in the lower register the vocal bands were longest in the production of the highest note, and in the middle register they were also longest while the highest note was being sung. By comparing the photographs representing these notes (Figs. 20, 21) it can be seen that the vocal bands were as long, if not

FIG. 20.



FIG. 21.



the longest, while the highest note of the lower register was being sung. In this subject the vocal bands increase in length in each register, but they attain as great a length in the lower as in either of the registers above, if not greater. It is generally thought that the pitch is raised by the vocal bands increasing progressively in tension and length. In regard to length this is true in some cases, while in others it is only true as applied to a register, not to the whole voice.

"The next pair (Figs. 22, 23) represent high C sharp and a still higher note in the voice of this subject—F sharp. In that representing F sharp we may observe that the cavity of the larynx is greatly contracted, the epiglottis not so high as when C sharp was being sung. In fact, the four walls of the larynx are crowded toward the centre, and the epiglottis is curled inward. The arytenoid cartilages are almost if not quite in contact. The vocal bands are very short and look like threads. The most surprising revelation made in this picture is that there is no stop-closure. It is pos-

sible that there was slight contact between the edges of the vocal bands in the posterior portion of the glottis, but it is my opinion that air was passing

FIG. 22.



FIG. 23.



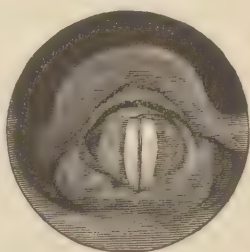
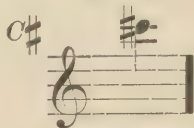
between the edges of the vocal bands the entire length of the glottis when this photograph was taken.

"While the photographs represented in Figs. 24, 25 were being taken the subjects were, without question, singing pure head-tones. I felt morally certain, while viewing the vocal bands in the laryngoscopic mirror attached to the camera at the instant the photographs were taken, that there was close contact between the posterior third of the vocal bands in the first subject, and a 'jam' between the edges of the posterior half of the glottis in the second. The photographs, however, show that in the first subject the vocal bands are closer together behind than in front, but there is no

FIG. 24.



FIG. 25.



contact. In the second there is contact, but the edges are by no means as tightly pressed together as they seemed to be in the mirror. The eye was deceived while viewing the reflection in the mirror, and this deception has occurred not infrequently in my studies."

There is, perhaps, a greater uniformity in the opinions of writers in regard to the mechanism of the vocal bands in the production of tones in the upper or head register than upon any other action of the glottis in singing. Indeed, I am not aware that there is a writer of prominence who does not believe that stop-action occurs in all head-tones. From the revelations made in the photographs of the glottis, taken while head-tones were being sung, I would offer the opinion that contact of the vocal bands in the first five or six tones does not occur in half the cases.

We have before us a sufficient number of these marvellous photo-laryngoscopic illustrations to be able to appreciate the conclusions of Dr. French with regard to the movements of the vocal bands in the production of the tones of the several registers,—viz. :

“1. The larynx may act in a variety of ways in the production of the same tones or registers in different individuals.

“2. The rule—which, however, has many exceptions—is that the vocal bands are short and wide and the ligamentous and cartilaginous portions of the glottis are open in the production of the lower tones; that as the voice ascends the scale the vocal bands increase in length and decrease in width, the aperture between the posterior portions of the vocal bands increases in size, the capitula Santorini are tilted more and more forward, and the epiglottis rises until a note in the neighborhood of E, treble clef, first line, is reached. The cartilaginous glottis is then closed. The glottic chink becomes much narrower and linear in shape, the capitula Santorini are tilted backward, and the epiglottis is depressed.

“When the vocal bands are shortened in the change at the lower break in the voice, it is mainly due to closure of the cartilaginous portion of the glottis, the ligamentous portion not usually being affected. If, therefore, the cartilaginous glottis is not closed, there is usually no material change in the length of the vocal bands.

“As the voice ascends from the lower break the vocal bands increase in length and diminish in width, the posterior portion of the glottic chink opens more and more, the capitula Santorini are tilted forward, and the epiglottis rises until, in the neighborhood of E, treble clef, fourth space, another change occurs.

“The glottic chink is then reduced to a very narrow slit, in some subjects extending the whole length of the glottis, in others closing in front or behind or both. Not only is the cartilaginous glottis always closed, but the ligamentous glottis is, I believe, invariably shortened. The arytenoid cartilages are tilted backward and the epiglottis is depressed. As the voice ascends in the head register the cavity of the larynx is reduced in size, the arytenoid cartilages are tilted forward and brought closer together, the epiglottis is depressed, and the vocal bands decrease in length and breadth. If the posterior part of the ligamentous portion of the glottis is not closed in the lower, it is likely to be in the upper notes of the head register.”

We come now, as a conclusion to the study of the vocal mechanism, to

the subject of the organs of resonance. These consist of all the passages from the vocal bands to the lips,—viz., the ventricles, the false cords, the brim of the larynx, the epiglottis, the pharynx, the naso-pharyngeal space, the soft and hard palates, the cavities of the nose and mouth.

The first three mentioned have but little influence except to confine and direct the vibrations upward toward the larger spaces above. The epiglottis also seems to possess as its function only a reflection of the tones.

During the lower tones the epiglottis ascends, and stands practically out of the way of the directly ascending vibrations. But as the tones go higher in the registers the epiglottis descends, and, advancing into the line of vibrations, deflects them backward against the pharynx.

The pharynx supplements the function of the resonators already mentioned, confining the otherwise scattering vibrations and deflecting them again forward against the soft palate.

In the soft palate we possess practically the only movable resonator.

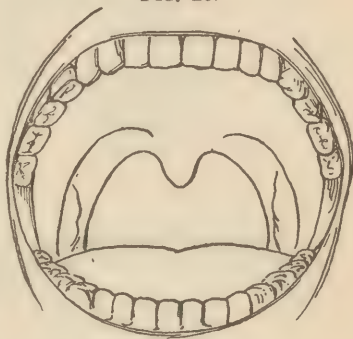
The anterior pillars are formed by the projection of the palato-glossi muscles, the posterior pillars by the projection of the palato-pharyngei muscles, and in the triangular interval are situated the tonsils. These muscles, in conjunction with three others, levator palati, tensor palati, and azygos uvulæ, make a very movable body of the soft palate.

In the accompanying illustrations¹ (Figs. 27–30) is well shown the action of the uvula and palatal arch in the singing of different tones. The soft palate rises with the ascending scale, the arch becomes narrower and higher, and the uvula diminishes in size until it almost vanishes.

The naso-pharynx and cavities of the nose take but little part in the development of timbre. As may be observed from the foregoing illustrations, with correctly-sung tones of the medium or higher registers the ascending arch cuts off the passage of air into the above-mentioned cavities; it is therefore only during the singing of tones of the lower register that some of the vibrations are permitted to escape into these passages, and with these tones only should we expect any nasal quality whatever.

The hard palate is a continuation of the soft palate, the two together forming the most important of the resonators. The mouth also is sometimes called a resonator, but it seems just to include the mouth with the tongue and lips under a different name as the speech-producing mechanism. The action of the vocal mechanism is complicated by a condition from which all other musical instruments are free. The latter produce songs without

FIG. 26.



¹ Browne and Behnke, *Voice, Song, and Speech*, p. 167.

words, the former only with words. Words are composed of vowels and consonants, but for the purpose of vocalization may be considered to be composed only of vowels. The vowels are the phonetic letters, while the consonants are the connecting, the distinguishing, the distributing letters. In uttering both vowels and consonants we see the wide play of the muscles

FIG. 27.

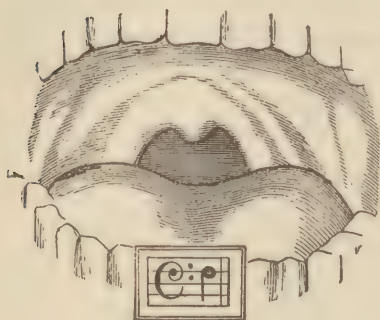


FIG. 28.

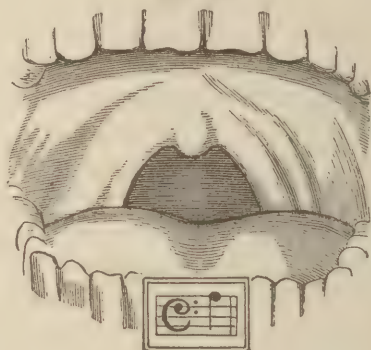


FIG. 29.

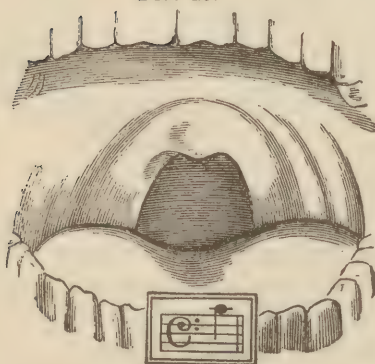
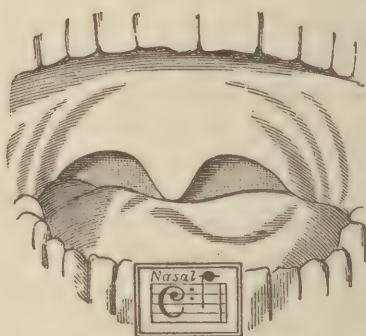


FIG. 30.



of this mechanism. In pronouncing the vowels *e*, *a*, *aa*, *o*, *oo*, more and more of the mouth and lips is brought into operation, *e* being formed at the back of the mouth, the sound of the other vowels, in the order given, advancing gradually forward, until the *oo* is uttered almost entirely by the elongated lips. The consonant *p* is the vowel *e* emphasized by the sudden parting of the compressed lips. The linguals demand for their proper utterance the active co-operation of the tongue. So that the uttering of every separate vowel or consonant, as one may readily see by making the experiment, demands a different attitude of mouth, tongue, and lips. In conclusion, in order to understand more fully the formation of a tone, built up of partials upon its fundamental series of vibrations until it exists like a musical ladder extending from the cords to the lips, let us examine the accompanying diagram (Fig. 31).

The vibrations, coming at right angles from the vocal cords, which are

tilted forward by the raising of the arytenoid cartilages, strike upon the epiglottis, tilted backward by the ascending thyroid cartilage, and, recoiling from this sounding-board, fly across the open space to the almost perpendicular surface of the pharynx, whence they rebound again upon the soft palate and uvula, and, reflected once again from these surfaces, finally escape to the open air; starting, as the vibrations do, as a mere sound of a certain pitch, it collects the echoes of itself in its zigzag course until, as it escapes from the lips, it is composed of a numerous company of sounds, all alike but of different strength. This constitutes tone.

We are now in a position to understand that vocal culture demands *technical training* of three distinct sets of mechanism, the bellows or breathing muscles, the larynx, and the resonators. Over the first and last of these we possess quite conscious and distinct and visual control, and for this reason we are able to lay down certain simple rules which can be followed more or less completely without the aid of a teacher:

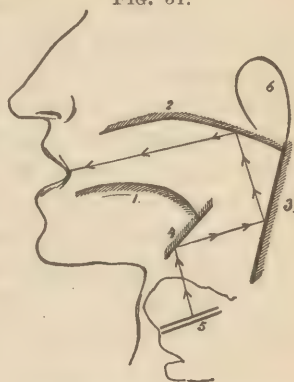
Of the muscles of respiration the diaphragm is the most important. The chest-muscles enlarge the air-capacity of the chest, making as it were a storage receptacle, upon the contents of which the diaphragm produces a steady compression. During correct vocalization this storage receptacle never becomes so emptied of air as during ordinary expiration, but remains partially filled.

Try the experiment of inspiring as much air as possible, and then singing one of the tones of the middle register, holding it as long as any air remains. You will observe that the diaphragm is first brought into action, and when that muscle has quite expended its force the chest-muscles are brought into use. During the first few seconds of the transference of expulsive force to the chest-muscles the tone remains clear and smooth, but if a special effort is made to continue singing the tone longer, the chest-muscles are contracted still farther in the effort to expel more air, and the tone becomes thin and wavering in character. It is yet a question of discussion as to the precise configurations of the chest and abdomen during correct singing and speaking, but observation of very many performers leads us to the conclusion that no hard-and-fast rule can be laid down with regard to contour of chest and manner of breathing.

The first essential is to abandon all bands, stays, or corsets which in any degree confine the abdominal parietes, and thus give room for the natural expansion of all the organs which enter into the process of deep breathing.

The second essential is to breathe naturally; that is, in such a way as to

FIG. 31.



1, Surface of tongue; 2, soft and hard palate and uvula in phonative position; 3, pharynx; 4, epiglottis; 5, vocal cords in vocalizing position; 6, naso-pharyngeal space. Dart and line show reflection of vibrations to and fro until escaping from the lips.

fill the storage reservoir to its fullest capacity in a manner requiring the least muscular effort. In accomplishing this all sudden or spasmodic muscular action must be avoided; the head should not be thrown far back nor the shoulders raised. The air should be taken into the lungs through the passages of the nose, for in this way the hoarse or audible inspiration of air of some singers is avoided, and, the passages through the nose being of less capacity than the passages through the lips direct to the larynx, the inflow of air through the former is less rapid. Hence the respiratory muscular action is under some restraint and better control.

The accompanying diagrams (Figs. 32-37), adapted from Browne's "Medical Hints on the Singing Voice," illustrate the varying capacity of the chest according to the method of inflation, and represent the average changes in contour produced during the processes of singing and speaking.

FIG. 32.

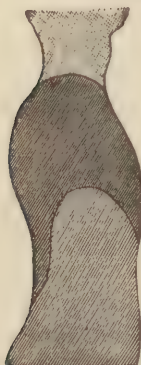


FIG. 33.



FIG. 34.



FIG. 35.



FIG. 36.



FIG. 37.



The hearer should never be conscious, by sight or sound, of any unusual effort on the part of the singer in taking breath.

The third essential is to control the action of the diaphragm, so that its active pressure upon the confined air may be smooth and regular; in other words, teach it to husband the supply in the storage reservoir.

The fourth essential is to avoid using the chest-muscles as a motive power.

It is possible for the beginner to practise these rules in the following manner. Clothed in such a way as best to disclose the outline of the chest and body, let him stand at a convenient distance from a mirror and sing single tones of the middle register, holding each tone up to the wavering point, in inspiration avoiding any action of the shoulders, all extra lifting of the chest-walls, all unusual bulging of the abdomen; in expiration fixing the chest-walls and contracting the diaphragm as slowly as is possible for the full rendering of the tone. He will soon be gratified by the discovery that the number of seconds during which a tone is properly sung is increasing, thereby showing that his control of the breathing is improving.

In the training of the organs of resonance the student can do much for himself, because he is able to watch his own efforts and observe the various positions taken by these organs. The most essential exercise to learn is to open the mouth freely and wide. The severe criticism of Deacon¹ on the slovenly enunciation of the English race applies equally well to the vast majority of the American people. Their lazy, thin-lipped, nasal utterance handicaps them on the very threshold of the art of singing and speaking. "And he opened his mouth and spake" is less characteristic of this country than of any other in the civilized world. Of all languages, probably the Italian best prepares the resonators for the art of singing. As Deacon well says, "We have to study hard before we can arrive at the Italians' starting-point." The simple rules laid down by Browne and Behnke² for the training of the mouth are so admirable that I venture to copy them here:

"The student, standing before his mirror, is invited to try the following:

"1. Open the mouth as widely as possible every way; look at the tongue, the soft palate, and the back of the throat; then shut the mouth again. Repeat this several times.

"2. Open the mouth widely enough to put two fingers between the teeth; then smile so as to draw the corners of the mouth sideways, until they are each bordered by a little perpendicular line; now suddenly alter the shape of the mouth by protruding the lips as much as possible, with only a small opening between them, as in whistling; the change must be quick and smart. Repeat this several times.

"3. Smile with lips firmly closed, drawing the corners of the mouth as much sideways as possible; then smartly protrude the lips as in whistling, but still firmly closed, with no aperture whatever. Repeat this several times."

The tongue should be trained to lie flat, out of the way of the outpouring tones. This is a much more difficult matter than one would at first suppose. So unruly is it in some subjects that numerous devices have been invented for the purpose of compressing and controlling it, all of which are

¹ "Singing," *Grove's Dictionary of Music and Musicians*.

² *Voice, Song, and Speech*, Browne and Behnke, pp. 160-162.

bad in practice as in theory. But patient exercise of this organ in the proper ways will at last bring it under control except in a few quite irredeemable cases. I quote again from Browne and Behnke the following rules :

"1. Open the mouth widely ; put out the tongue straight, and as far as possible ; draw it back smartly, and try to let it lie flat and low, but touching the lower teeth all round. Repeat several times. In this, as well as in the remaining tongue exercises, great care must be taken to keep the lips and the lower jaw perfectly still.

"2. Put the tip of the tongue against the lower front teeth, and then push it out as far as possible ; this will of course completely roll it up ; then draw it back smartly, as in exercise No. 1. Repeat several times.

"3. Keep the root of the tongue as flat as you can ; raise the tip, and push it perpendicularly and quite slowly toward the roof of the mouth ; then lower it again as gradually, until it has once more assumed its original position. Repeat several times.

"4. Raise the tip of the tongue as in exercise No. 3, and move it gradually from one side to the other, so that the highest point of it describes a semicircle. Repeat several times."

We come now to the last of the resonators, namely, the soft palate, of which the uvula and hard palate form a part.

In Figs. 27-31 we have already shown how movable this phonetic arch is, and it has been explained that with each ascending note the uvula rises higher, until the tone of the pharynx is cut off entirely from the influence of the vibrations. If it were not so, the accompanying tone would have an unpleasant nasal or, as it is sometimes called, throaty quality. To prevent this the student may practise the singing of one or more tones of the middle register to *oo*, *oh*, *ah*. Beginning with *oo*, the tone is brought as far forward as possible, and the change in vocalizing to *oh*, *ah* may be almost imperceptibly made without altering the location of the tone.

The pronunciation of some of the consonants, particularly *t* and *k* before the *oo*, is accompanied by a simultaneous elevation of the uvula, a position which, as we have shown, is necessary to the absence of the nasal tone. It is hardly necessary to discuss the much-vexed question of the cause of the nasal tones, as the consensus of opinion is that such tones are caused by the escape of some of the vibrations through the channel of the nasal cavities, and not, as has been often asserted, by their occlusion.

Let me again refer to the rules laid down by the authors just quoted for the training of the soft palate :

"Stand in front of your mirror as before ; open the mouth widely, and see that the back of your throat is well illuminated.

"1. Breathe through the mouth ; the soft palate will be moderately raised, with the uvula in its normal shape and position. In expiration through the mouth the uvula will be thrown a little forward.

"2. Open the mouth again, and inhale through the nostrils ; this will

cause the soft palate to fall and the tongue to rise, which has the effect of shutting the mouth at the back, just as you shut it in front by closing the lips. Exhale in the same way, and the mouth will remain shut at the back. Repeat several times.

"3. Inhale through the nostrils, with the mouth wide open. Prevent the tongue from rising; keep it still and flat. You have learned to control your tongue, and will have no difficulty on that score. This will compel the soft palate to come down smartly, which is just what is wanted. Now exhale through the mouth, when the soft palate will rise again."

The training of the larynx is a much more complicated and perplexing study. If we recall what has already been affirmed of the want of uniformity in size and insertions of the muscles and bands of different larynges, and also of the varied images produced by different tone-organs in singing the same note, we cannot but agree, first, that no fixed rules can be laid down which the student can follow; second, that the laryngoscope can give little aid either as to the kind of voice or the individual method of producing it; third, that, owing to the location of the larynx, it is beyond visual study; fourth, that the study and training of the voice are to-day, as in the past, and probably always will be, an art almost entirely empirical.

Semon, from whose valuable brochure on "The Culture of the Singing Voice" I have already quoted, writes on this subject as follows: "Nothing can be more detrimental to the true interests of the noble art of singing than to be led astray by the well-meaning but over-enthusiastic adopters of incomplete physiological facts into a wrong groove, under the impression that the rules which were preached were so firmly based upon facts of unimpeachable scientific accuracy that nothing remained to the professors of the art itself but to bow before the superior knowledge of the theorist. It cannot be too strongly insisted upon that the millennium has not yet come, and that at the present time the claims of the laryngoscope to teach and lay down the rules for really reasonable and scientific training of the singing voice are by no means established. The rational training of the singing voice can only as yet proceed upon the basis of empirical experience."

No attempt will be made, therefore, to lay down rules for the training of the larynx, and we close this part of the subject with the earnest recommendation to students of singing to select as teachers only the best of the present day.

HYGIENE OF THE VOICE.

It may be laid down as a broad and general principle that whatever conduces to and promotes the continuance of robust health serves as an invaluable factor in the development and noblest existence of the singing voice. As my readers are persons of scientific and professional attainments, it will be necessary to give only a cursory view of this part of the subject.

As air is the medium of sound-production, the question of atmosphere is an especially important one. There are very few singers, either amateur

or professional, who are not at times exposed to the vitiated atmosphere of interiors,—the air of well-filled, brilliantly-lighted drawing-rooms, the draughty and often cold air of theatres, loaded with carbonic oxide gas and dust, and the stuffy, germ-laden, superheated air of many houses and hotels.

I remember, two years since, calling upon a celebrated prima donna and finding her lodged in an ill-smelling, badly-ventilated apartment. It was not to be wondered at that toward the end of the season her voice had lost something of its earlier freshness and purity of tone, nor that she was unable on account of illness to keep her promised engagements.

The forced exposure of singers to bad air should make them more careful as to the atmosphere of their homes, and also induce them to correct by exercise in the open air any possible injury to the voice. The outer atmosphere can do no harm to the voice except during the hours immediately following the exertion of singing. At such times not only should the voice have complete rest, but also the atmosphere breathed ought to be pure and moderately warm. Under the term exercise may be included any form of active but gentle muscular exertion, to satisfy the individual taste. Riding or walking, rowing, gymnastics or fencing, are all of advantage to the singer, as they strengthen the muscles, expand the chest, improve digestion, and so promote good health. Some three years since, I had the pleasure of meeting one of the greatest living sopranos in the wilds of Tyrol, on the top of a mountain over nine thousand feet above the sea, in the midst of a snow-storm, in August. It was difficult to recognize, in the person clad in short woollen skirt and jacket, with high boots and rough Tyrolean hat, the wonderful songstress who had thrilled audiences during the preceding winter in Wagnerian opera. During the weeks of tramping she roughed it with the best, never sparing herself for weather or distance. This constituted her preparation for the labors of the coming winter. During the active season of singing, however,—I speak particularly of professional singing,—exercise should never be carried to the point of producing the least physical exhaustion. No special rules need be laid down for bathing and clothing. Cold sponging or the cool plunge, with plenty of friction afterwards, is to be recommended. All hot, steam, or Turkish baths should be avoided, as they are apt to be followed by reaction, with consequent congestion of the larynx and pharynx. The clothing should ordinarily be light and warm. Heavy clothing weighs down the thorax and hampers the free action of the lungs. But no wraps are too warm to protect the heated body or wearied throat after prolonged singing. Such should always be worn, the preference being given to furs during the interval between theatre or concert-hall and the house, and also during drives in the open air.

The *diet* of the singer should consist of plain, substantial food, including a small daily allowance of a pure dry wine. Mixed dishes and *entrées*, as well as desserts, should be avoided. Tea, beer, and strong liquors

should also be avoided, while coffee and mineral waters in moderation are not harmful. The custom of many singers of eating but one course at a time, consisting of meat, vegetables, dry bread, and dry wine, is an excellent one, since in this way the appetite is not tempted to overload the stomach. As regards the time for eating, it is generally considered that the heartiest meal should be taken after the exercise of singing is finished, and very little food within three hours of the exercise of the voice. The question of the use of tobacco—of course only smoking is meant—is one on which opinions are divided. A well-known tenor remarked to me that he could not sing well unless he first smoked a mild cigar, and that he did not believe that any really great male singer was abstemious in this respect. On the other hand, my experience in the treatment of many singers leads me to the conclusion that tobacco is indirectly harmful in producing more or less muscular relaxation and diminution of vigor, and directly harmful in causing local inflammation of the upper air-passages. Tobacco has more deleterious effect in cold and damp climates than in warm and dry ones. Individual idiosyncrasies and the quality of the tobacco smoked vary the degree of harm done by the habit.

THE VOICE IN SPEAKING.

It will be remarked by my readers that only casual mention has been made of the speaking voice while discussing the questions relating to the cultivation of the singing voice. This has been an intentional omission, for two reasons,—namely, because all descriptions of the mechanism of voice apply equally well to the latter subject, and because the special subject of voice in speaking can be best treated separately.

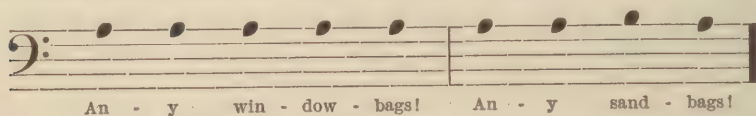
What constitutes a speaking voice? In the strictest sense, a speaking voice is one whose amplitude of vibrations is sufficient to enable it to be heard by a number of listeners located at variable distances from the speaker. The voice from man to man, as in dialogue or trialogue, cannot be included under this definition. If this definition is accepted as fairly correct, the deduction will readily follow that the superiority of one speaking voice over another consists in the greater ease of being heard. Now, what are the essentials of the superiority—or in other words, what are the necessary characteristics—of a voice used successfully in speaking?

First, the musical quality. Of two sounds of the same pitch and intensity of vibration, the one fortified by the greater number of upper partials will carry farther than the other. With every added partial the tone becomes stronger in its vibratory impulses, and therefore fuller and more penetrating.

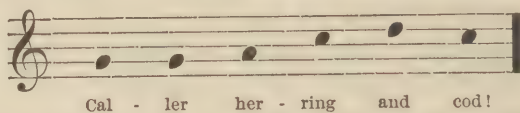
Hullah¹ says of it, "The recognition of this fact would seem to have been coeval with the infancy, if not the very birth, of oratory. It is attested in the well-ascertained practice of pagan antiquity, in the tradi-

¹ The Speaking Voice, 1884, p. 14.

tions of the Christian Church, and even in the nature-prompted utterances of the street-crier. The *accentus ecclesiasticus* may or may not be justifiable on æsthetic grounds: there is no occasion to fight its battle on any such. Practical convenience—absolute necessity sometimes—is at hand to account for its origin and justify its long-continued use. The first person who ever attempted to address a very large assembly must have discovered, by the time he had uttered a dozen words, that if what he had to say was to be made not only audible but intelligible to any but those immediately about him, his utterance must be partially musical, and that the more numerous his audience and the larger his auditorium the more musical must that utterance be. It is purely gratuitous, however, to speculate on what might, could, would, or should have been the practice of past times, historic or pre-historic, in this particular. Every factory, every ship, and (more familiar instance) every street will furnish us with examples in plenty of perfectly musical utterance. At the beginning of each winter may be heard, from end to end of any tolerably quiet London street,



while no one who has spent a day in Edinburgh at a certain season of the year can have failed to catch the ring of the Newhaven



Neither vender of sand-bags nor fishwife has any intention of commending his or her wares through the meretricious aid of art; the one has not been encouraged by the probable example of Demosthenes and Æschines, nor does the other know—assuredly she would be shocked to learn—that her song is a rag of popery. Window-bag man and caller-herring woman want to be heard as far and as well as possible, and they set about making themselves heard in the easiest and most effective manner."

Second, this musical quality must be used by the speaker without any perceptible singing tones. In singing the tones are divided by regular intervals and given with a definite rhythm, and the range of tone extends over several octaves; but in speaking the range of tone extends, or should extend, only over a few notes, the tones glide imperceptibly into one another, as if they were sliding up and down a plane, and a rhythmical utterance, except in reciting verse, is wholly absent. No method could be worse in oratory than a sing-song, drawling delivery, and many preachers and public speakers fall into this habit from an over-anxiety as to the carrying quality of their voices. On a Palm Sunday, not many years since, I attended service at Westminster Abbey, in order to hear a famous canon of the

cathedral. He began his discourse with the words, "This is Palm Sunday," and his expression of the sentence can be illustrated by the accompanying notes :



And throughout his discourse there was very little variation from the same strain.

As musical tone without musical rhythm is necessary to a good speaking voice, it follows that the attention given to the development of the entire vocal mechanism in singing should be given also in the latter case, with this difference only, that, as the speaking voice need possess only a limited range of notes, no attempt should be made to increase this range. Indeed, much harm can be done by attempting to combine an oratorical with a singing voice. The quality of flexibility, so important to the latter, would be cultivated with a consequent loss of strength, so necessary to the former. The training of the singing voice within the range of one register is not only sufficient, but also alone permissible.

Years since, the writer spent the summer months at Salzburg, in the society of a friend who had recently been appointed a reader at St. Paul's Cathedral. In order to fit himself for the important duties of reader to so vast a cathedral, he had betaken himself to the clear mountain air of Tyrol, and for many hours each day he exercised his voice and vocal mechanism, within the range of the few essential tones, in the open air. In this way he learned to manage his voice in a great space and developed a marvellous degree of strength and penetration. The suggestions previously given as regards the training of the motive power and organs of respiration are equally applicable to the study of oratory. Here, however, may be noted a striking difference between the two methods. The song without words of instrumental music becomes the song with words in singing; but the perfect rendering of these words is not of the highest importance in singing. To so manage the mouth as to aid the tones to escape in perfect form is the essential, and if the pronouncing of any syllables or words be likely to interfere with this, the perfect rendering of the tone has the prior claim. But in speaking the perfect enunciation of words and syllables is of the greatest importance, to which the strength and pitch of tone must always be subordinate. There is another marked difference between the speaking and singing vocations. The vocalist is conscious of the large amount of work necessary not only to train but to retain his voice; hence the daily vocal exercises, the constant vigilance over the conditions of general health, the avoidance of everything which tends to reduce his voice below its perfect standard. But in the speaker no such care is usually taken; no special exercise of voice or frame is taken previous to some hour or two's delivery

of an oration in a large audience-chamber. The preacher uses his voice for some hours during one day of the week, and during the other six days it remains silent. It is not necessary to point out that such a course is altogether contrary to the best rules of the art, for the art of speaking, as well as the art of singing, demands constant and vigilant attention. Certain simple rules may be given for the guidance of the student of the art of oratory :

First, practise daily. Let the student remember that the art of speaking is like the art of hurdle-racing, rowing, or polo-playing, in that daily exercise is necessary to keep the muscles in perfect trim.

Second, practise in a pure air containing an average amount of moisture. If the air be too hot, too cold, or too dry, or contain dust or other impurities, the vitiated air will irritate the mucous membranes and produce secondary inflammations.

Third, practise only in a large space. A public hall or the open air in mild weather and on still days is preferable. If this be unattainable, practise in a suite of rooms with the windows of the farthest room open. It is necessary that the returning vibrations should come from a distance ; if not, the voice is overwhelmed. When, later on, it becomes necessary to accommodate the voice to the requirements of greater penetration, it is impossible to do so without this previous training.

Fourth, learn to speak the language of your audiences readily, fluently, and correctly. The correct pronunciation of a language cannot be learned from books or teachers. Constant association with cultivated people, constant attendance at plays acted by the best play-actors, following carefully the speeches of the most finished orators of the day, assist in forming a correct standard of speech. But it must be confessed that, as the mouth and tongue of a child are more easily trained than those of an adult, if childhood be passed in an atmosphere of bad enunciation the defects then acquired are seldom if ever entirely eradicated. It is said that a provincial, though spending years in Paris, is always recognized by his un-Parisian pronunciation. To acquire the true Parisian accent one must be born in Paris.

Some twenty years since, the writer was invited to be present at an operation performed by a distinguished surgeon of London, and was surprised and amused to hear him, during the explanatory remarks preceding the operation, drop his *h*'s and return to pick them up again.

The bad pronunciation of the American people is proverbial. Even the American statesman is known to take grave liberties with the English language, and there are few preachers of to-day who can read a discourse of forty minutes without committing some error in language or in method of speaking.

It will be well, therefore, if the student of oratory can be impressed with the gravity of the task before him, which is not only to learn the best methods of using his voice, but also to acquire the habit of elegant enuncia-

tion among a people who constantly assail his ears with a multitude of colloquialisms.

In conclusion, it is to be recommended to the student to put himself, from the first, under the guidance of a competent teacher of elocution, and, after some months of careful preparation, to go out into the world for further study, putting himself as much as possible within the hearing of the most celebrated masters of the art of speaking.

VOCAL DEFECTS AND THEIR CORRECTION.

Defects in using the voice are even more numerous than the organs which help to produce them. Any imperfection in nerve, muscle, or passage which is included in this process causes defect in speech. We can divide the causes of defects of speech, then, into three classes,—namely, *first*, defects caused by abnormal congenital formations; *second*, defects caused by abnormal conditions of nerve-supply, either congenital or pathological; and *third*, defects the product of diseased conditions of the passages of speech.

Defects of speech caused by abnormal congenital formations include all malformations of the mouth, tongue or teeth, palate, arch of the palate, tonsils, nose, pharynx, and larynx. As illustrations of these malformations medical literature yields us cases of undue growth of either one or both the lips, of hare-lip, of tongue-tie, of hypertrophy of the tongue, of irregular growth of the teeth, of cleft palate, of absence of the uvula, of bifurcated and hypertrophied uvula, and of malformations of the remaining vocal passages. These malformations cause defects in speech by interference with correct syllabification and with the free and natural escape of tones from the larynx to the open air. Defects caused by abnormal conditions of the nerve-supply include the congenital or acquired defects of stammering and stuttering, aphasia, and the incoherencies produced by cerebral disease. A description of the latter does not come within the scope of this article.

Aphasia is of two kinds, atactic and amnesic, the former being the result of disease or congenital malformation of the phonic centres, the medulla oblongata and pons, and the latter the result of disease of many parts of the brain-substance, particularly of the anterior lobes and corpora striata. By atactic aphasia is meant an inability to utter the words which the brain is still competent to force the hand to write; by amnesic aphasia, the incompetence of the brain correctly to formulate words in speech or writing.

The terms “stuttering” and “stammering” are often used indiscriminately, yet, although they are quite distinct phenomena, they are often present in the same individual. Whilst occasionally the precursors of brain-disease, particularly of bulbar paralysis and sclerosis of the brain and cord, they are usually congenital in origin or acquired through reflex nervous irritation

from some remote part of the body. The description given by Kussmaul of these three disorders of speech is worthy of a place here:¹

"Stammering consists in a failure of the muscles of speech as regards both their individual contractions and those combined contractions which are requisite for the enunciation of consonants and vowels. The obstacle to their independent or their co-ordinate contraction may be of a coarse, mechanical nature, situated in the jaws, teeth, palate, etc., or in the muscles themselves; or it may be peripheral, situated in the motor nerves of the tongue, palate, and face; or it may be central, due to some failure on the part of the motor centres to originate impulses of sufficient power to put the muscles of speech in action; or the transmission of the impulses may be disturbed, or they may be diverted into wrong channels. Broadly speaking, the imperfect utterance of syllables is due to some imperfection in the working of the external or internal mechanism of articulate phonation; the stammering may be of external or of internal origin.

"Stuttering (*Stottern*) is due not to any peripheric hinderance of a mechanical kind to the activity of the organs of speech, nor to any central failure of motor power, nor yet to any interruption of its transmission; it is due simply and solely to a spasmodic inability to execute that 'vocalization of consonants' (union of consonants with vowels) which is requisite for the formation of syllables. The attempt to fuse a consonant with a subsequent vowel into a syllable, sometimes even the attempt to utter a syllable beginning with a vowel, brings on spasm of the muscles of speech, the spasm not being confined to the muscles actually engaged in the formation of particular letters, but spreading to the phonic and respiratory muscles likewise; nay, the central irritation occasionally radiates over many other muscular regions also.

"In aphasia, finally, the word as a whole is wanting, or it is uttered in some mutilated form, or one word is substituted for another. It is not merely the constituent letters of a word that drop out at random, or are misplaced or wrongly accentuated, whereby the word is twisted out of shape; it is the word itself that drops out of our speech, or presents itself in a new and not seldom quite mutilated form. It is no longer the mere structure of the word that is shattered; the combination of words into sentences is at fault."

In speaking of the correction of vocal defects, those of the first class—namely, defects due to malformation—belong to the regions of surgery rather than of therapeutics, whilst those of the second class—those due to cerebral disease—become the special property of the pathologist. It is only with regard to two of the three defects of the second class—viz., stuttering and stammering—that we are able to make any suggestions as to treatment and possible correction.

The first indication is to remove any cause which produces or might

¹ Ziemssen, vol. xiv. p. 665.

produce reflex nervous irritation ; the second, to strengthen and calm the nervous system by suitable tonics, food, and régime ; and lastly, upon discovering in what set or sets of muscles the difficulty lies, to direct our attention particularly to a proper drill of these muscles by some of the numerous methods, more or less empirical, which have been explained in preceding pages of this article.

ACUTE PHARYNGITIS.

BY MAX THORNER, A.M., M.D.,

Professor of Clinical Laryngology and Otology, Cincinnati College of Medicine and Surgery; Laryngologist and Aurist, Jewish Hospital; Consulting Laryngologist, Ophthalmic Hospital, etc., Cincinnati, Ohio.

ACUTE CATARRHAL PHARYNGITIS.

Synonymes.—Acute sore throat; acute inflammation of the pharynx; *angina catarrhalis acuta*.

Etiology.—Acute catarrhal pharyngitis is considered by many one of the typical remainders of those affections which we were formerly wont to term “diseases caused by a cold.”¹ It is true that “catching cold” then played a more important rôle in the etiology of diseases than it does now; we have learned but during the last decade that many of the diseases supposed to have been caused by “colds” were in reality produced by pathogenic germs or other causative factors. In fact, serious objections have been raised against the term “a cold.” But it cannot be denied that what for convenience’ sake we call “a cold” is one of the principal etiological factors in ordinary cases of acute catarrhal pharyngitis. These colds may be direct or indirect; and acute pharyngitis is in many persons most commonly observed after the feet have become chilled. For this reason we find this affection much more common in those seasons when people are more apt to take cold, as during the changeable days of autumn and early spring. Moreover, we find more sufferers in countries where thermometrical and barometrical changes are frequent and abrupt than in those where changes do not take place so frequently and then only by degrees.

It must, however, be borne in mind that epidemics of common acute catarrhal angina do occur in seasons when these fluctuations of thermometrical and barometrical conditions do not exist, and that there are also sufficient observations to prove that cold *per se* cannot in all cases be looked upon as the cause of the angina. There must be, in addition to the cooling off, another factor, rendering the cold but a predisposing element; or the cold may be entirely absent. We all have experienced that an acute catarrhal pharyngitis may occur where not the slightest exposure to cold can be traced. Fick,² in a dissertation upon this subject of “catch-

¹ The Germans have one word for it, “Erkältungskrankheiten.”

² Ueber Erkältung, Zürich, 1887, p. 25.

ing cold," denies that a "cold" is a principal cause of *any* disease. He says that in most cases where "cold" was called the cause of the disease, according to his observations, no disease followed at all, and that in the small number of cases where the "cold" was followed by disease a causal connection between the two could not be established with certainty. Bernabei¹ has found that many cases of primary acute angina are caused by streptococci, especially the erythematous form, which is epidemic and contagious and occurs in spring and autumn. Rendu and Boulloch  ² are even of the opinion that all acute anginas are of bacterial origin, and similar views are held, of late, by many other observers.

There is another important group of etiological factors for acute pharyngitis. Many acute febrile diseases, as scarlet fever, measles, small-pox, erysipelas, typhoid fever, are ushered in, or accompanied as secondary symptoms, by acute pharyngeal inflammations. These are also found after the suppression of cutaneous exanthemata, or in the course of syphilis; after injuries to the throat, as scalding, use of strong acids or alkalies, ingestion of too highly seasoned foods or irritating liquors or vapors; also after certain drugs, like atropine, antimony, iodide of potassium, mercurial preparations, etc., and following abuse of tobacco and wine, and improper use of the voice. Acute pharyngitis may also be observed as a reflex symptom of gastro-intestinal and genito-urinary disturbances, or as being directly propagated from morbid processes in the neighboring organs, especially in the nose and the mouth.

Predisposing factors are any conditions that impair the general health, like disturbances of digestion, assimilation, and circulation; constitutional diseases, like syphilis, rheumatism, and tuberculosis; also the existence of chronic catarrhal conditions of the naso-pharyngeal tract, the presence of granular pharyngitis, hypertrophy of the tonsils, obstructions of the nose of whatever kind, and, in fact, anything that leads to mouth-breathing. One may, at times, speak of an inherited tendency to catarrhal affections of the mucous membrane in several children of one family, as also, in certain persons, of an increased vulnerability of the pharyngeal mucosa, which appears to be with them a *locus minoris resistenti  *. This is especially the case in persons of sedentary habits who have very little out-door exercise and who are prone to chronic constipation; also in people who are in the habit of living in overheated rooms, or who are compelled to breathe continually a vitiated atmosphere; and in children whose over-careful parents, in the endeavor to protect them, bring them up as hot-house plants and neglect an early hardening of the skin.

Age and sex seem to have but little influence in inviting this disease.

Symptoms.—The symptoms depend largely upon the severity and the extension of the process. The lower pharynx, or the pars oralis of the pharynx,

¹ Sulle Forme di Angina da Streptococco, Riforma Med., November 3, 1891.

² Gazette des H  pitaux, June 12, 1891.

the soft palate, and the uvula, alone may be affected ; or the upper pharynx—*i.e.*, the pars retro-nasalis, including the vault of the pharynx—alone may be the seat of the inflammation, in which case it is proper to designate it by a special name,—either pharyngitis superior or naso-pharyngitis, or (etymologically better) rhino-pharyngitis. Many authors, indeed, describe this affection as a disease *per se*, and the peculiar symptoms certainly justify them in doing so. On the other hand, the inferior and the superior pharyngitis are so frequently found in the same patient that, for practical reasons, they may be considered together. In fact, J. Moure¹ is of the opinion that an acute catarrh of the naso-pharynx accompanies almost always a simple case of acute pharyngitis. In the beginning of an attack of acute angina there is a slight rise of temperature, although mild cases are seen where this symptom is entirely wanting, and where if it were not for the slight discomfort in the throat the angina might pass entirely unnoticed. Yet the temperature may rise considerably in severe cases, especially in children. One must not be surprised to find, though as a rare occurrence, in adults a temperature of 105° F.; and an initial chill, especially in the epidemic form, has been noticed among the first symptoms. Young children may have convulsions. The patients, particularly the younger ones, complain frequently of a tired feeling ; and in the cases that are of rheumatic origin the whole neck may be painful to the touch and stiff as in torticollis. The throat feels hot and dry, and the patient often complains of a peculiar scratching sensation. This dry sensation, however, is, according to Rühle,² not always dependent upon an actual dryness of the mucosa. However, these symptoms may or may not be present. In all cases pain is complained of, which may vary from a slight disagreeable sensation to that of intense suffering. In some cases deglutition only is painful, in others these painful sensations are present at all times, and more so towards evening. If the post-nasal space is also affected, or is the exclusive seat of the affection (pharyngitis superior), the pain is localized in this region. It is, however, remarkable that patients who have this affection for the first time find difficulty in localizing the pain of which they complain ; they generally designate the pharynx, or even the larynx, as being the seat of their trouble, or they refer to the roof of the mouth.³ In all such cases it is of importance not to omit an examination of the naso-pharynx. The seat of this inflammation explains readily why such symptoms as fulness of the whole head, headache, earache, tinnitus aurium, and deafness (either

¹ Manuel pratique des Maladies des Fosses nasales et de la Cavité naso-pharyngienne, Paris, 1886, p. 255.

² Ueber Pharynxkrankheiten, Volkmann's Sammlung Klinischer Vorträge, No. 6, p. 24.

³ In this connection it may be mentioned that the sense of locality of the pharyngeal mucosa is but poorly developed. Schadowaldt, in an essay upon this subject (Ueber die Localisation der Empfindungen in den Halsorganen, Deutsche Medicinische Wochenschrift, 1887), has shown that physiological as well as pathological irritations of the whole respiratory tract are frequently referred to wrong localities.

partial or complete) may be accompanying features. In severe cases both catarrhal and purulent otitis media, with possible perforation of the drum-head, are seen either early in the beginning or as sequelæ of the naso-pharyngeal affection. Bosworth¹ calls special attention to the fact that the first stage of abnormal dryness of the membrane will sometimes continue in the naso-pharynx from two to even four days, causing a period of considerable distress to the patient.

The act of swallowing becomes more difficult. The small muscles participating in the act of deglutition are inflamed and impeded in their action by the swelling of the mucosa covering them. These are especially the glosso-palatini and pharyngo-palatini muscles, at times also the constrictores pharyngis and the levator veli palatini. Speaking also is painful and difficult, for the same reasons, and the voice has, in well-developed cases, a peculiar dead sound, and sometimes a nasal twang which has been thought to be characteristic of angina, and which, as well as the regurgitating of fluids through the nose, is due to the functional inactivity of the soft palate.

The feeling of burning and dryness in the throat disappears soon, when the secretion, often as early as during the first day, makes its appearance. This secretion consists of a grayish, viscid mucus, sooner or later to be followed by a genuine muco-purulent secretion. It is either expectorated or, in the superior pharyngitis, discharged through the nose or swallowed; and it may by running down the pharyngeal wall, or by gathering during the night, cause even retching and vomiting. It also is apt to cause a peculiar, offensive breath, occasionally noticeable in the morning. If the larynx is affected by contiguity, or if secretion collects in or about the larynx, hoarseness and a hacking cough are present. Occasionally neuralgic pains are complained of, as pain in the tympanum, conveyed, according to Lennox Browne,² to Jacobson's nerve along the main trunk of the glosso-pharyngeal nerve; and also facial neuralgia (Bosworth) and intense lancinating pains in the eyeball (John N. Mackenzie).

The local symptoms are the following. The mucous membrane of the soft palate, and frequently also of the pharynx, becomes deeper in color, from a slight flush to a deep scarlet red. In the course of the affection it often becomes rough, of a velvet-like appearance, and sometimes, though not often, small, superficial erosions may be seen; the hyperæmia may be intense, and occasionally dilated blood-vessels can be distinguished. Later on the swelling of the mucosa sets in, which consists of a serous transudation and may develop into a typical œdema. Sometimes the uvula is drawn to one side, and the whole soft palate is in a paretic condition, responding but slowly and inaccurately during phonation; and even a true paralysis of the soft palate has been observed in rare cases. Hyperæsthesia of the mucosa is often very pronounced.

¹ A Treatise on Diseases of the Nose and Throat, New York, 1889, vol. i. p. 508.

² The Throat and its Diseases, American edition, Philadelphia, 1887, p. 166.

The course of the disease is mostly short, resolution in from four to eight days being the usual outcome. Mild cases may be limited to a single day or two. The fever, even if high in the beginning, decreases soon, morning remissions to normal temperature occurring often as early as twenty-four hours after a temperature of 104° and above has been reached. There is, however, a danger that the acute catarrhal form will continue into the phlegmonous form, and also that the œdema may descend with great rapidity to the larynx. J. H. Bryan¹ has collected the reports of ninety-six cases of acute œdema of the larynx, of which four were preceded by acute pharyngitis.

In a number of instances, after the main symptoms of a pharyngitis have subsided, *restitutio ad integrum* does not take place, either for lack of treatment or for other reasons. There remains a degree of congestion, and sometimes also a scanty tenacious discharge. The patient experiences no further discomfort, but a certain vulnerability is present, relapses occur after slight exposures, and there is a tendency towards a permanency of these conditions, terminable in a subacute and eventually chronic form of pharyngitis.

Pathological Anatomy.—This does not differ from that of catarrhal inflammation of other mucous membranes,—viz., active hyperæmia, produced by engorgement of blood-vessels, stasis, round-cell infiltration of the mucosa, serous infiltration of the submucosa, pus-corpuscles, epithelial cells, and micrococci in the secretion.

Treatment.—If a case of acute pharyngitis presents itself early it is always advisable to try to abort it. The patient should be kept in a warm but not overheated room, and if it is a child preferably in bed, and the atmosphere should be kept pure and moist. The time-honored practice of giving quinine in large doses in the beginning of a cold, and opium in smaller ones, is still recommended by good authorities. Dover's powder, repeated frequently in small doses, is a favorite prescription for this purpose. Although I am not prepared to deny the efficacy of this régime, I am not in the habit of using it, having seen just as good results without it as with it. But the first thing to be done is to stimulate the diaphoretic action of the skin in the outset, and good results may be looked for if it is done early. It is generally sufficient to give hot aromatic drinks in large quantities, and have the patient well covered. Hot alcoholic drinks, whiskey toddy, etc., also hot lemonade, are in common use in this country. A good old-fashioned steaming hot foot-bath, preferably with a little ground mustard added to it, is one of the home remedies not to be underestimated. Turkish baths, or vapor baths at home, are recommended for the same purpose, but are somewhat risky on account of the subsequent exposure. At any rate, a good diaphoresis, even if it do not abort the attack, is often followed by decided relief to the patient. Strict attention must always be paid to the

¹ Acute Œdema of the Larynx, etc., Medical News, Philadelphia, February 6, 1892.

bowels, and the least tendency to constipation should receive immediate attention. The mercurials, either calomel or blue mass, given in the evening, and followed in the morning by one of the milder bitter waters, have been long in common use for the constipation accompanying inflammatory conditions of this kind, and are still very largely depended upon. However, anything that will relieve the coprostasis so commonly found in these affections is satisfactory. My habit has been of late to use the fluid extract of cascara sagrada in doses of from fifteen to forty drops at bedtime, to be repeated if necessary in the morning, and the results have been satisfactory.

The fever very seldom requires special attention. If it is necessary to do anything in this respect, one of the antipyretics, preferably phenacetin, may be given, the dose to be regulated according to the severity of the case and the age of the patient. The dryness of the first stage is in many cases more troublesome than the pain; and relief is promptly afforded by pilocarpine hydrochlorate in doses of one-tenth, one-sixth, to one-quarter grain, given three times a day, supplemented by such local applications as will be referred to below. The pain, the local as well as the neuralgic, requires sometimes special attention. This is noticeably the case in acute rhinopharyngitis, and in those forms apparently associated with a rheumatic diathesis. It is a good rule never to give morphine in any of the acute inflammations of the upper air-tract, at least not in sleep-producing doses, and certainly not in children. Phenacetin and antipyrin, in doses of from five to ten grains, repeated as often as necessary, will be generally sufficient. Aconite, in the form of tincture of aconite, has been used universally since Ringer's¹ and Bartholow's² recommendation of it, and is, indeed, exceedingly valuable not only for relieving pain, neuralgic and otherwise, but also for reducing the temperature and lowering the arterial tension. In children's practice, it has, in fact, been employed more than any other remedy in acute inflammation of the upper respiratory tract. Bartholow recommends to give it in from one-half-drop to one-drop doses every half-hour until an impression is made on the fever movement, and then every hour or two. It is also very conveniently given in tablet triturates of which each contains one-half or one drop. Bosworth,³ referring to the pain in acute naso-pharyngitis, is very outspoken in his praise of Duquesnel's aconitine for this symptom. He recommends giving it (conveniently in the form of tablet triturates) in doses of gr. $\frac{1}{500}$ every hour, "until the pain is relieved, or the constitutional effect of the drug is manifested, as shown by numbness and tingling about the fauces or lips, vertigo, or fainting." Of course, considerable care must be exercised in using so powerful a drug. This author has not only seen prompt action from this drug in relieving pain, but thinks also that it has a beneficial effect on the inflammatory process.

¹ A Handbook of Therapeutics, New York, 1879, p. 425.

² A Practical Treatise on Materia Medica, New York, 1887, p. 599.

³ Op. cit., vol. i. p. 513.

In 1887, in a paper¹ read before the Cincinnati Academy of Medicine, I called attention to the fact that salol is a valuable remedy in relieving the pain in acute affections of the throat of whatever kind. Since that time my observations have been confirmed by Capart and Gouguenheim,² and especially by Jonathan Wright, of Brooklyn. The latter author³ reported fifty well-observed cases of acute tonsillitis and pharyngitis, in the overwhelming majority of which the results were exceedingly satisfactory, showing that salol relieves pain in anginas of any kind. The dose of salol in such cases is from ten to fifteen grains, four to six times a day. It may be given safely to children, the dose to be reduced according to the age, to from two and one-half to ten grains.

The local treatment must in the beginning avoid every irritation of the hyperæsthetic mucous membrane. Sometimes it is possible to reduce the inflammation by a cold pack, or a Leiter coil with cold water, around the neck, allowing, at the same time, small pieces of ice to melt in the mouth. The local reduction of temperature frequently shortens the pathological process, and often relieves the pain quite efficiently. If these beneficial effects are not soon obtained, or when a more copious secretion makes its appearance, heat must take the place of cold. Fomentations, and gargling with hot water, frequently repeated, are generally grateful to the patient. Instead of plain hot water, hot aromatic infusions,—*e.g.*, chamomile tea,—or hot milk (in children), or hot claret, may be used to advantage. Gargles of borax, bicarbonate of sodium, chlorate of potassium, glycerite of tannin, sulphate of zinc, etc., either alone or in combinations, all in two-per-cent. solutions, to which any of the mild antiseptics may be added, are frequently prescribed.⁴ None of these remedies, however, have any specific action, as has been thought of chlorate of potassium; and this latter drug should never be given internally, on account of its toxic effects. Astringents, as gargles or as topical applications, must not be used on an acutely-inflamed mucous membrane during the first stage. Especially contra-indicated are strong solutions of nitrate of silver, so commonly used in former times in the earliest stages of acute pharyngitis.

Inhalations of vapor, either of hot, steaming water alone, or of hot water to which some tincture of benzoin (one drachm to a pint) has been

¹ Salol: with Report on the Use of Salol in Affections of the Throat, etc., Cincinnati Lancet Clinic, December 10, 1887.

² *Annales des Maladies de l'Oreille*, etc., November 9, 1889.

³ Salol in Acute Tonsillitis and Pharyngitis, *American Journal of the Medical Sciences*, August, 1890.

⁴ It may be stated, however, that gargling should not be insisted upon when it is very painful, on account of the necessary action of the muscles involved in the inflammatory process. The liquid, in gargling, can at best reach only the soft palate and the faucial region. Gargling, to be beneficial, should be practised with the head reclining, thus allowing the liquid to run back as far as possible, the gargling sound—*i.e.*, the sound caused by the expulsion of air through the liquid—being unnecessary. Most of the gargles are best prepared with equal parts of water and glycerin.

added, are very soothing in this stage. They may be made with any of the inhalers found in the instrument-makers' shops; or a cup, a tin pail, or any other vessel filled with hot water (140° to 160° F.) will answer. The patient inhales through an ordinary kitchen funnel or a paper cone, the large end of which covers the receptacle. If the post-nasal space is principally affected, one may use a post-nasal spray with an alkaline solution,—for instance, Dobell's solution. Very soothing has proved in my hands a mixture of one-half teaspoonful of sodii bicarbonas dissolved in a pint of warm water to which are added ten to fifteen drops of tincture of benzoin. This mixture is to be used very gently, once or twice a day, with a post-nasal syringe. Also warm water to which a little glycerin has been added, warm sage-tea, or warm milk, used in the same manner, is very grateful to the patient. In small children whose nasal mucosa is swollen one may safely use warm milk, injecting it into the nose, or dropping it in with a medicine-dropper.

I fully agree with Bosworth¹ that medicated lozenges are, as a rule, of no great value in the treatment of this affection. The local effect is very limited, and any constitutional effect may be obtained by remedies administered in a more convenient form. However, as Lefferts² says, they may be considered a useful adjuvant to other local treatment, and they enjoy considerable reputation among physicians, as well as among the laity. The lozenges are usually made with a fruit-paste; those of Bosworth are made with extract of liquorice. They are generally medicated with an astringent, sedative, stimulant, or antiseptic,—benzoic acid, carbolic acid, tannin, guaiacum, cubebs, lactucarium, iodoform, extract of krameria, and extract of opium being most frequently used. If gargling is too painful, spraying the throat, either with a hand-ball atomizer or with the steam atomizer, may be resorted to. The remedies recommended above for gargles can be employed for sprays. Where a steam atomizer is used the strength of the solution must be four per cent., as the process of atomization by steam reduces the strength of the solution one-half. As soon as the secretion has appeared, astringents will greatly aid in promoting a prompt recovery. The best method is to apply them directly, by means of a curved cotton-carrier, to the pharynx and, if need be, to the naso-pharynx. In the latter case it must be borne in mind that the inflammation is generally universal, and that the application must be made thoroughly, though great care must be taken to do it very gently. Force should never be used to carry the cotton wad up between the tightly-drawn-up palate and the pharyngeal wall. The muscles must be allowed to relax, and then, with a quick movement, the applicator is to be carried up to the pharyngeal vault.

Of all local applications, I prefer two- to four-per-cent. solutions of

¹ Op. cit., vol. ii. p. 35.

² A Pharmacopœia for the Treatment of Diseases of the Larynx, Pharynx, etc., New York, 1884, p. 61.

chloride of zinc in glycerin; alum, tannin, sulphate of zinc, chloride of iron, nitrate of silver, in two- to five-per-cent. solutions,—all, with the exception of argentic nitrate, made with equal parts of water and glycerin,—are also very useful. The rule is to begin always with the weaker solutions. Caustic applications and insufflations of powders are to be deprecated. Cocaine applications I do not recommend, as a rule. The relief they afford is of short duration, and the reduced calibre of the engorged blood-vessels is soon followed by relaxation, and, as Schroeder¹ justly remarks, “the reaction brings with it an aggravation of the patient’s condition which can only be relieved by repeated applications.” Still, under certain circumstances the local use of cocaine may be advisable, for instance, where intense swelling of the parts causes dyspnoea or exceedingly severe pain on every attempt at swallowing, preventing feeble patients from taking any nourishment at all. Unna and his followers have recommended ichthyol, locally as a gargle or spray, in one- to two-per-cent. solution, and internally in doses of from two to four grains three to five times a day.

Any ear-symptoms that present themselves must, of course, be attended to immediately. In this connection Wendt² very justly says, “The ear, especially, often requires immediate *timely* attention, which is of more value than any subsequent course of treatment.” The inflation of the middle ear after Politzer’s method should be practised upon the first indications, catheterization during the acute stage being always too painful and too irritating. If, in spite of this treatment, an accumulation of catarrhal or purulent secretion should take place in the tympanic cavity, paracentesis of the membrana tympani is indicated, and should be performed without delay.

Prophylaxis.—Acute pharyngitis could in many cases be avoided. We find, indeed, people who are seldom, if ever, subject to it, and others who, having been afflicted with it again and again, have lost the tendency to it by modifying their habits of living. A proper hygiene ought to begin in early life. Children who are brought up as hot-house plants are sure to be the most frequent sufferers from catarrhal inflammations of the upper air-passages. In such cases a reasonable hardening must be recommended. They should be given daily a cold sponge bath, or wrapped in a sheet wrung from cold water, to be followed immediately by vigorous friction of the skin with a rough towel. If the cold water is not well borne, moderately warm water will answer, to be followed, if possible, by a cold douche. However, this whole procedure must be adapted to circumstances, and sometimes carried out only by degrees. The neck, as a rule, should be washed every day with cold water, and not be wrapped in woollen and silken protectors whenever the children leave the house. It has also

¹ The Treatment of a Cold, New York Medical Record, January 30, 1892.

² Ziemssen’s Cyclopædia of the Practice of Medicine, American edition, New York, vol. vii. p. 49.

been recommended to spray the neck every morning, on rising, with iced water.

Underwear should be a woollen fabric, not only in men, but also in women and children, consisting in winter of tightly-fitting garments from the neck down to the ankles. The change from heavy to light clothing must not be permitted too early in spring, when a few warm days are apt to be followed by chilly and cold ones. Beverley Robinson,¹ in his exhaustive chapter on the prophylaxis of acute coryza, insists also on the care of the feet, and very justly so, for, as is well known, many cases of acute pharyngitis have their origin in wet or chilled feet. Shoes should scarcely ever have thin soles for out-door wear, and for cold weather heavy double-soled shoes or cork-soled shoes are recommended. In wet weather impermeable shoes are necessary. No impediments to a free circulation of blood and unembarrassed respiration, in the form of tight lacing and tightly-fitting collars, ought to be permitted. Habitual constipation requires constant attention. The living-rooms must be of proper temperature and well ventilated. Avoidance of noxious influences, and active physical exercise, especially for those of sedentary habits, are absolutely necessary. Chronic affections of the naso-pharynx and nasal obstructions must be attended to.

SUBACUTE CATARRHAL PHARYNGITIS.

If, either from neglect or in spite of treatment, the acute inflammation does not quickly subside, or if the acute form changes into the subacute form, the local treatment must be carried out with stronger applications. Subacute catarrhal pharyngitis is not a special disease. The symptoms are more or less the same as in the acute form, only of less intensity. Actual pain is not present, but deglutition is often somewhat difficult. There may be a hacking cough; and, while the secretion is diminished, a very annoying retching sensation from the accumulation of mucus is complained of, which may, after awakening in the morning, even cause vomiting. The voice is often husky, or has a nasal twang, and is tired after little exertion; and the patients are frequently conscious that there is something the matter with their throats. Locally there are hyperæmia and swelling, which may be universal or circumscribed. In the latter case either the lateral parts of the pharynx, or the pharyngeal vault, or the soft palate, and here specially the uvula, alone are affected. The latter may be considerably thickened and elongated. If this condition is not relieved, some form of chronic pharyngitis will result.

The local treatment consists in the daily application of the pigments recommended for acute pharyngitis, only in stronger solutions (three to ten per cent.). An excellent pigment is a solution of iodine in glycerin (two to ten per cent.), made with a sufficient amount of iodide of potassium to insure solution. A few drops of carbolic acid (Mandl) may be added, or,

¹ A Practical Treatise on Nasal Catarrh and Allied Diseases, New York, 2d ed., p. 42.

as Scheech¹ recommends, of oil of peppermint to improve the taste. It is well always to begin with the weaker solutions and make daily applications. Later on, when improvement begins, one application every other day, and finally twice a week, is sufficient. The general *régime* is the same as in the acute form; the bowels, especially, need attention; and smoking and chewing tobacco, indulgence in excesses, and undue exertion of the voice, are to be strictly prohibited.

ACUTE UVULITIS.

During an attack of acute catarrhal pharyngitis, as has been mentioned previously, as well as in other acute processes in the faucial region, the uvula may become involved. In such cases it is inflamed, enlarged in every diameter, and œdematous. It is, however, possible that the inflammation will be limited to the uvula alone, and that there will be no evidence of other changes. The causes are the same as those that lead to acute inflammation in general. A sudden exposure to cold is as yet considered one of the most frequent causes. Traumatism of any kind may produce this affection. Thus, J. Solis Cohen² relates a case where caustic applications caused an intense œdema of the uvula. The symptoms are sensation of a foreign body in the throat, pain during deglutition or at other times, and sometimes dyspnœa on account of the intense swelling. The diagnosis is easy: the uvula is swollen, enlarged, at times enormously, and is whitish and glistening, showing that there is an œdematous distention of the mucous membrane.

Treatment.—Hot gargles or ice are sometimes useful; but in most cases time is lost with them, as well as with astringent applications. Free and numerous scarifications give immediate relief by allowing the pent-up serum to escape. Bosworth³ prefers puncturing (ten to twenty punctures) the whole uvula. Amputation of the uvula for acute œdema is probably rarely necessary, although it has been done in aggravated cases, giving complete relief in a short time.

PHLEGMONOUS PHARYNGITIS.

Synonymes.—Pharyngitis abscedens; peritonsillitis; peritonsillar abscess; quinsy.

Etiology.—Regarding the etiology of this disease, there can be no doubt in the light of our present knowledge of pathogenesis that it is of bacterial origin. It is asserted, however, that it may, like the acute catarrhal form, be caused also by taking cold,⁴ especially in persons who have been previously reduced by disease or want of the necessities of life;

¹ Die Krankheiten der Mundhöhle, des Rachens und der Nase, Leipzig und Wien, 1888, p. 138.

² Diseases of the Throat and Nasal Passages, 2d ed., New York, 1879, p. 220.

³ Op. cit., vol. ii., 1892, p. 91.

⁴ See pp. 250–251, with respect to “cold” as an etiological factor.

furthermore by traumatism, after operations, scalding, cauterizations (with chemical caustics or the galvano-cautery). It also occasionally accompanies acute infectious diseases, as typhoid fever, small-pox, and especially scarlet fever and measles; in these diseases, however, it is probably due to the invasion of the streptococcus pyogenes.¹ It certainly stands to reason that in a locality so constantly exposed to minor traumatisms the possibility exists of minute lesions of the upper epithelial layers of the mucosa where pathogenic germs, abundant as they are in the oral cavity,² may readily find an entrance and nidus for development. Some authors, especially Bosworth,³ are inclined to think that rheumatism plays an important rôle in the production of this disease. I could not convince myself from my own observations that this occurs at all frequently.

Symptoms.—The disease begins with violent symptoms, headache, and a general feeling of malaise, in the midst of good health. An initial chill may be observed, and the temperature rises considerably; the pulse is rapid, and delirium is not unfrequently an early symptom, especially in children. Deglutition is exceedingly painful, the pain and obstruction increasing rapidly, so that finally even liquids are refused. Schech⁴ says that phlegmon of the pharynx is, next to tuberculosis, the most painful of all throat-affections. The throat, dry at first, is soon filled with a thick, tenacious, and offensive secretion; salivation follows, the tongue becomes coated, and the fetor of the breath is great. Complications on the part of the middle ear (violent earache, etc.) are more frequent than in catarrhal pharyngitis. The respiration may be seriously embarrassed, and even dyspnoea, especially while the patient is sleeping, is at this stage not uncommon. Every attempt at swallowing is characterized by a contortion of the face and is avoided as much as possible, and liquids are regurgitated on account of the swollen and paralytic condition of the soft palate. The patients become rapidly reduced from loss of sleep, pain, and want of nutrition. The voice has a nasal twang, and is indistinct; the mouth cannot be opened, by reason of the extension of the inflammatory process to the tissues surrounding the maxillary articulation, and examination becomes very difficult. Sometimes the mouth cannot be entirely closed, the lower jaw being kept immovable. The submaxillary and cervical glands are generally swollen and exceedingly painful.

Local examination shows the soft palate to be of a deep purple hue, and highly oedematous, so that the fauces are frequently entirely obliterated. The enormous swelling renders the soft palate entirely immovable; the secretion is muco-purulent, later on purulent, and sometimes tinged with

¹ I cannot agree with those authors who consider the pharyngitis accompanying scarlet fever as a disease *sui generis*. It is nothing but one of the symptomatic expressions of this disease, and may manifest itself in the simple or in the phlegmonous form, but does not merit a name of its own, nor separate consideration, nor special treatment.

² W. D. Miller: The Human Mouth as a Focus of Infection, *Lancet*, August 15, 1891.

³ *Op. cit.*, vol. ii. p. 106.

⁴ *Op. cit.*, p. 144.

blood, and ecchymoses and hemorrhages into the mucosa are sometimes seen. The tonsils may participate in the phlegmonous process; but the inflammation of the tonsils is generally superficial, though they may be greatly enlarged. Principally affected is the peritonsillar tissue. It is in this location that suppuration generally takes place. This locality is called by Chiari¹ the spatium pharyngo-maxillare, and is bounded by the tonsils, the internal pterygoid muscle, and the palatine arches. The swelling may extend into the post-nasal space, causing a complete obstruction between the nose and the throat, and may also descend towards the larynx, producing œdema of the latter and threatening dyspnoea.

Course.—The duration of the disease is from four to fourteen days. Either absorption of the infiltration takes place, and the symptoms subside gradually, the affected parts returning to their normal condition, or suppuration sets in, and with it increases the severity of the symptoms. This is the most trying time for patient and physician, when every day adds to the pain and difficulty, until the pus escapes either after operative measures or spontaneously. The spontaneous bursting of the abscess takes place ordinarily through the anterior palatine arch, and may occur after coughing or swallowing, or during sleep. When this last happens there is danger of the pus making its way into the trachea. It is not always possible to see the spot where the pus has forced its way to the surface. In such cases discharge may have taken place through the posterior arch. At all events, after the escape of pus, improvement is rapid; refreshing sleep is the first relief, and convalescence progresses generally favorably.

Relapses, however, are not so very rare; or the other side may also become affected, and then convalescence is protracted and tedious. There are still other and greater dangers. The pus may burrow into the cellular tissues of the throat, into the œsophagus, into the mediastinum, and even towards the external parts of the neck, causing abscesses below the deeper cervical fascia, in the submaxillary glands, and in the muscles of the tongue; or the process may lead to ulceration of great blood-vessels, as, when originating in the peri-tonsillar tissue, to erosion of the carotid, and even general septicæmia may be the outcome, in all of which cases the prognosis is necessarily very unfavorable.

Treatment.—A good, nourishing, and stimulating diet (milk, beef-broth, peptonized foods, whiskey, good wine) must be given from the beginning. Lennox Browne² recommends that tonics, as iron, chlorate of potassium, and bark, be given from the start. Others recommend quinine. If the patients persist in refusing to swallow any food whatever,—and this is most frequently the case with children,—rectal alimentation must be resorted to. The bowels need from the beginning careful attention, costiveness being very common and troublesome. For the purpose of aborting the attack

¹ Wiener Klinische Wochenschrift, 1889, No. 43.

² Op. cit., p. 172.

Morell Mackenzie¹ has recommended tincture of guaiac, or lozenges containing two grains of resin guaiac, which latter have enjoyed great reputation, though it has never been proved with certainty that this drug can cut short an attack already started. Aconite, in drop doses, is also frequently given (as in catarrhal pharyngitis); and Bosworth² believes that it is possible to abort an attack within the first twenty-four hours by giving ten grains of quinine and one grain of opium, administering a hot foot-bath, evacuating the bowels by fifteen grains of calomel, to be followed by a saline purgative and giving sodii salicylas, and applying locally to the throat sodii bicarbonas. Helbing³ has of late highly recommended rubbing of the skin over the corresponding site, to wit, below the angle of the inferior maxilla, with a cotton wad moistened with three or four drops of croton oil. If this were done the first day, he succeeded in aborting the attack. The eczematous inflammation resulting from the application heals in five to eight days, and is not so troublesome as the prospect of having to go through a well-developed attack of phlegmonous pharyngitis.

The object of the local treatment is to reduce the inflammation and to alleviate the pain. For the first purpose cold, in the form of the ice pack, or Leiter coil with cold water, around the neck, also gargles of ice-water, sucking of cracked ice, etc., are usually employed. While they may be tried in the beginning, I should not attach too much importance to them, for I believe, with Jurasz,⁴ that they will rarely, if ever, abort an attack, and that the relief produced by them is of but short duration. It is much better to begin early with hot fomentations around the neck, hot gargles, and hot inhalations, in order to accelerate suppuration and to shorten in this way the duration of the disease.

The internal administration of morphine to relieve the pain is out of the question in an affection where dyspnoea is threatening. Great relief has followed the administration of salol⁵ in large doses. Antipyrin and phenacetin, the latter also combined with salol, give good results and have the additional advantage of reducing the elevated temperature. Painting the inflamed parts with cocaine in five- to ten-per-cent. solutions relieves the pain, though for a short time only, but often sufficiently to allow the patient to take some food. B. Fraenkel⁶ recommends the injection of cocaine into the inflamed parts as very efficient to relieve the pain. A five-per-cent. solution of menthol in albolene, or a mixture of ether fifteen parts, chloroform ten parts, and menthol one part, applied either with the cotton carrier or as a spray, has afforded temporary but decided relief.

¹ Diseases of the Throat and Nose, American edition, Philadelphia, 1880, vol. i.

² Op. cit., 1892, vol. ii. p. 120 *et seq.*

³ Internationales Centralblatt für Laryngologie, Rhinologie, etc., 1890, vol. vi. p. 564.

⁴ Die Krankheiten der oberen Luftwege. Heidelberg, 1891, p. 127.

⁵ See p. 256.

⁶ Berliner Klinische Wochenschrift, 1886, Nos. 17 and 18.

Any middle-ear complication must, of course, be treated according to the indications as set forth elsewhere in this System.

When an abscess has formed, a free incision is indicated, as relieving the distressing symptoms almost instantaneously. A bulging forward of the swollen tissues indicates at times the spot where the incision must be made. Frequently the presence of pus cannot be determined so easily, but must be diagnosticated from all other conditions combined. However, with the aid of the following method, recommended by Stoerk,¹ fluctuation may sometimes be discovered quite early. The physician puts the fingers of one hand externally under the angle of the lower jaw, pressing the skin and all the tissues inwardly, while the index-finger of the other hand moves slowly over the infiltrated parts, beginning high up on the soft palate and sliding downward towards the tongue. When the two index-fingers moving and pressing towards each other meet in a spot where the tissues offer less resistance, imparting a doughy sensation, this is the point for the incision. This little operation is done with a sharp-pointed knife, the parts having been previously cocainized, if possible. The so-called pharyngeal knife may be used, having a short blade and a long steel shank with rounded edges to prevent injury to the lips or tongue. However, any bistoury will do, the larger portion of the blade having been previously wrapped with narrow strips of adhesive plaster or of tissue-paper, one-half or three-quarters of an inch of the blade being left uncovered. The knife must be introduced flat, with the cutting edge towards the median line, the tongue being firmly pressed down with a tongue-depressor. The knife is then plunged into the spot previously decided upon, and the opening, upon withdrawal, enlarged towards the median line. In this way all danger of injuring any of the great blood-vessels is avoided. Stoerk² recommends that the incision be made parallel to the palatine arches, and that a finger be introduced into the opening,—certainly a very painful procedure. Schech³ introduced a grooved director to facilitate the escape of pus; but even this may be omitted if the incision is large and deep enough. Sometimes it is advisable to make several incisions, or additional incisions during the following days may become necessary. After the operation hot gargles, frequently repeated, are to be prescribed.

But even if pus cannot be detected, and the symptoms are very severe, free and multiple incisions are of great value. In fact, it is not advisable to lose too much time by waiting for the manifestations of pus. Some authors advise against these incisions, as liable to cause sloughing, and affording, at the best, but temporary relief. However, in most cases suppuration follows soon in the track of the incision; and the depletion of the engorged blood-vessels acts very beneficially upon the whole process, pro-

¹ Klinik der Krankheiten des Kehlkopfs, der Nase und des Rachens, Stuttgart, 1880, p. 109.

² *Op. cit.*, p. 110.

³ *Op. cit.*, p. 147.

vided the incisions have been made generously. It must be added, however, that not in all cases do these benefits follow the operation; that, on the contrary, the disease sometimes progresses for the worse, as if nothing had been done, and that in such cases patients and friends are inclined to hold the incisions responsible for this aggravation of symptoms, on the principle of *post hoc, ergo propter hoc*.

If dyspnœa be severe, tonsillotomy may become necessary, in case the fauces are the seat of the obstruction. If, however, the dyspnœa is due to involvement of the larynx, and becomes dangerous, tracheotomy must be resorted to; but before doing this scarifications of the swollen tissues and hypodermic injections of pilocarpine in doses of one-tenth to one-quarter of a grain for adults may be tried. Intubation is probably of minor value in such cases, there being another obstacle to respiration above the tube in the faucial region.

ACUTE INFECTIOUS PHLEGMONOUS PHARYNGITIS.

Acute infectious phlegmonous pharyngitis, or primary acute infectious phlegmon of the pharynx, is the somewhat formidable name of a disease described as a new affection in 1888 by Senator,¹ of Berlin. The disease called heretofore phlegmon of the pharynx (peritonsillitis abscedens), described in the previous section, is harmless compared with this most disastrous affection. Otherwise one might look upon these two diseases as different only in degree. Sonnenburg² is, indeed, of the opinion that, under certain conditions, an acute septic phlegmon may develop out of a common phlegmon of the pharynx. Yet a number of observers have confirmed Senator's observations and agreed with him regarding the distinctive features of this affection, while other no less competent observers have insisted that this disease was known long ago and well described, though under different names. Virchow³ looks upon it as identical with the diffuse phlegmonous processes occurring in the mucous membranes in other parts of the body. Guttmann⁴ considers it identical with erysipelas of the pharynx. F. Semon⁵ is also of the opinion that all these processes, including the so-called angina Ludovici, are the same affection, caused by the same *materies morbi*, differing only in virulence. The name placed at the head of this section has, however, been adopted by many writers, though I am inclined to believe that such a name as pharyngitis phlegmonosa diffusa, or cellulitis phlegmonosa pharyngis, would be more expressive.

Symptomatology.—A characteristic of this disease is that it always attacks persons in the midst of good health. One of the earliest symptoms is sore throat. Fever is present from the beginning, and continues through the whole process; but it is a peculiar feature of this disease that the fever is

¹ Berliner Klinische Wochenschrift, 1888, p. 77.

² Ibid., p. 114.

³ Ibid., p. 112.

⁴ Ibid.

⁵ Verhandlungen des X. Internationalen Medicinischen Congress, Berlin, 1892, p. 185.

generally of a moderate degree, and the temperature seldom rises to 103° F. Hoarseness and aphonia are often present, and dyspnœa is not excluded. The submaxillary glands are swollen; the pharyngeal mucosa, and later also the laryngeal, are intensely congested, and sometimes œdematous. Localized suppuration is usually not detectable. The prostration is great, and the general condition is not unlike that of typhoid-fever patients. In some cases the patients become comatose towards the end. The urine always contains albumin. Death, as a rule, ensues suddenly, within a few days after the beginning of the disease.

The pathology of this affection, as learned from the limited number of recorded autopsies, is as follows: there is a diffuse purulent infiltration of the deeper parts of the pharyngeal mucosa, continuing from there to the larynx, trachea, and secondarily to other parts of the body, *e.g.*, the mucosa of the stomach. The lymphatic glands of the neck are swollen, and the kidneys are sometimes enlarged, as is also the spleen. No specific micro-organisms could be cultivated from the affected organs.

The diagnosis, considering the gravity of the symptoms, with the absence of everything pointing towards diphtheria, cannot be very difficult. The prognosis is, of course, very bad, almost inevitably fatal.

The therapy, as can be readily understood, is very limited. The disease is undoubtedly of bacterial origin, with an intense general infection of the whole system from the outset, and therefore local treatment can be of but little avail. We may try to relieve the most prominent symptoms. If asphyxia is imminent, tracheotomy may be resorted to, although nothing must be expected from it except some temporary relief.

PHARYNGITIS SEU ANGINA ULCEROSA.

Synonymes.—Ulcerated sore throat; angina nosocomii.

Etiology.—The disease is certainly of bacterial origin, though the specific micro-organism has not yet been recognized. Persons in good health may be attacked by it; but people previously weakened by other diseases, or by want of food and other causes, seem to be more disposed to it, as also persons who have been exposed to the continued influence of vitiated air, sewer-gas, etc., and such as come in contact with decaying organic matter. It has been found frequently in hospital nurses (hospital sore throat), in pathologists, and, according to Mackenzie,¹ in young medical students who devote a great deal of their time to the dissecting-room.

Course.—Sore throat is the first symptom. This symptom increases rapidly, soon rendering swallowing impossible. The temperature rises as high as 105° F.; general prostration is pronounced. The breath is offensive; the tongue is coated and dry, and its back often covered with grayish or greenish-looking masses. The glands under the angle of the jaw are in most cases enlarged and tender. Of the tonsils generally only one is en-

¹ Diseases of the Throat and Nose, American edition, Philadelphia, 1880, vol. i. p. 42.

larged, and sometimes considerably so, and is covered with a membrane-like deposit of yellowish or greenish color, which can be wiped off if some force be used. Then it is seen that the deposit covered a large ulcer or several small ones, which sometimes, though rarely, become confluent; and the crypts of the tonsils are full of similar putrid masses. Small ulcers may also be on the soft palate, which in all cases is acutely inflamed and at times is œdematous. The disease is of but short duration, recovery taking place in from six to fourteen days. The prognosis is always favorable, though recurrences are not uncommon.

Pathology.—There is an ulceration of the superficial layers of the mucosa and of the lymphoid follicles, causing a fibrinous exudation, mixed with epithelial and pus cells, detritus, and numberless micrococci, to be deposited on the surface of the tonsils.

Treatment.—The patient should always be removed from all surroundings that may have been the cause of his ailment.¹ It is good policy to give, from the beginning, tonics, as iron, quinine, wine, whiskey, and as much nutritious food as the patient will take. The fever must be treated on general principles; and the constipation almost always present requires some mild laxative. Locally, disinfectant gargles are to be used, especially of permanganate of potassium, chlorate of potassium, or carbolic acid. McBride² recommends painting the ulcerated surface with an oily solution (twenty per cent.) of menthol; or, if this or the gargling be too painful, a spray of bichloride of mercury (one to two-thousand). A coarse spray of peroxide of hydrogen (fifteen volumes per cent.) proved in my hands the most beneficial application. This must be used every hour, and applied in a very forcible manner and continued for several minutes. The patients may be allowed to suck pieces of ice; but often hot water as a mouth-wash is more agreeable to them, especially if it is flavored with some thymol, oil of wintergreen, or oil of peppermint.

As soon as the acute inflammation has somewhat subsided and the ulcers look cleaner, the diseased tissues require local treatment. A few applications of tincture of iodine—often, indeed, a single one—will work wonders. A suitably-curved probe or cotton carrier, wrapped tightly with cotton, is dipped into the undiluted or diluted (one-half with alcohol) tincture and introduced into the diseased follicles. Any constitutional weakness remaining must be treated according to the indications.

¹ Not long ago I saw, in consultation, a young lady, twenty-two years of age, who had a typical ulcerous angina. She had three relapses one after another. The house in which she lived was known for its poor sewer-connections. One of the sewer-vents opened directly below the window of the patient's bedroom, so that frequently pestiferous odors could be perceived rising from the badly-located opening. After the third relapse, removal of the patient to healthier surroundings was insisted upon; after which she made an uninterrupted recovery.

² Diseases of the Throat, Nose, and Ear, American edition, Philadelphia, 1892, p. 15.

GANGRENOUS PHARYNGITIS.

This disease is, fortunately, very rare. It is seen as a secondary affection during scarlet fever, diphtheria, measles, typhoid fever, small-pox, ordinary phlegmonous pharyngitis, and following traumatism and operations. There is also a primary gangrenous sore throat, which is still rarer. It is essentially a septicæmic process. The onset is very sudden, no epidemic influences prevailing, and no causes being ascertainable in individual cases. According to Trousseau,¹ who (in addition to Gubler²) has put on record the first well-described cases, this disease has "as its fundamental character mortification of the mucous membrane of the pharynx, which resembles gangrene of the mouth, appears suddenly, and sometimes extends to the cheeks and the lips."

The disease begins with sore throat, which increases rapidly in intensity. Soon black or greenish-black spots make their appearance upon the soft palate, the tonsils, and the posterior wall of the pharynx, and the mucosa around these gangrenous parts is of a livid red color. The breath soon becomes so terribly fetid that, once smelled, its odor is said never to be forgotten. It has sometimes been compared to the odor of fæces, and is considered characteristic of this affection. Cervical and submaxillary glands may or may not be swollen. The temperature is high in the beginning, but later on becomes subnormal. The prostration increases rapidly; laryngeal and pulmonary complications may set in; gastric and intestinal disturbances of the gravest character are liable to result from the swallowing of the putrid masses; and the patients die mostly from syncope. However, a few cases of recovery are on record.

The treatment must necessarily be directed against the general infection. Stimulating medication of the most approved kind must be resorted to from the beginning, and a nutritious concentrated food must be given at frequent intervals, if necessary, per rectum. Locally, cleansing and disinfecting applications should be made as thoroughly as possible; but a correct diagnosis will, from the start, exclude any great hope of recovery.

ERYSIPELATOUS PHARYNGITIS—ERYSIPELAS OF THE PHARYNX.

Erysipelas of the pharynx is not a very rare occurrence. In fact, Eichhorst³ says that erysipelas occurs more frequently in the pharynx than in any other of the mucous membranes of the body. The etiology and pathology are the same as those of erysipelas in other parts of the body. The disease is an infectious one, caused by the streptococci discovered by Fehleisen. This fact subverts all former theories as to the existence of a traumatic and an idiopathic erysipelas, the latter being mainly

¹ Lectures on Clinical Medicine, Philadelphia, 1873, vol. i. p. 328.

² Archives Générales de Médecine, 1857, vol. ix.

³ Handbook of Practical Medicine, New York, 1886, vol. iv. p. 128.

the result of a "cold." As a matter of fact, F. Cardone¹ has reported four cases where the streptococcus erysipelatosus was found and cultivated and rabbits were inoculated with the pure culture with positive results. As to its relation to primary acute infectious phlegmon of the pharynx, referred to above, it must not be forgotten that the phlegmon is a purulent infiltration of the deeper structures, while erysipelas is a surface process, having no tendency towards cellular infiltration.

Course.—Generally the affection is secondary, spreading by contiguity from any region of the head along the mucous tracts of the nose, mouth, or ear, the first being apparently a favorite location of the affection. There is, however, sufficient clinical evidence that an erysipelas of the pharynx may follow an attack in a distant part of the body. On the other hand, erysipelas of the pharynx may also develop primarily and gradually spread to adjacent integument. This is a fact well known and understood long ago. The pharynx, that much used and much abused union of the respiratory and digestive tracts, the base of the tongue, the soft palate, and the tonsils, favor, without doubt, the entrance of the pathogenic streptococci by reason of the constant and unavoidable minute lesions of their mucosa. This may also be said of the small openings normally existing in the epithelial covering of the tonsils. Gerhardt,² in an exhaustive essay on this subject, says that the pharynx is no doubt frequently the gate of admission for the streptococci, and that what at first appears to be a common pharyngitis is not unfrequently followed by an erysipelas of the face. The local affection may end in recovery in consequence of a gradual resolution; it may, as stated, extend to the face, or it may extend downward to the larynx, the bronchial tubes, and even the lungs, giving rise to the most serious complications.

Symptoms.—There may be a prodromal stage of from three to four days, with high fever, without any local symptoms in the throat. Otherwise, the latter are those of a very acute catarrhal pharyngitis. Pain is great, and the throat feels intensely hot and dry. There is great hyperæmia of the mucosa, with swelling, and sometimes œdema; at times blisters, filled with serum or pus, appear. The cervical and submaxillary glands are usually swollen, though generally in a slight degree (Wagner); and salivation is frequently present. Very severe are the general symptoms, as fever, prostration, etc.

Ordinarily the disease lasts from a few days to a week. The diagnosis is in the beginning somewhat difficult, except, of course, in cases where an external erysipelas preceded the affection, or where it is possible to find Fehleisen's streptococcus in the affected parts. The prognosis is doubtful, though generally good; certainly grave, however, when the affection is of a descending character.

The treatment, as regards the general symptoms, is the same as for

¹ Giornale Internazionale di Scienza Medica, April, 1888.

² Ueber Rothlauf des Rachens, Charité-Annalen, 1887, Bd. xii. p. 208.

erysipelas in general, consisting chiefly in the liberal use of stimulants, and in the exhibition of antipyretics whenever the temperature is very high; locally, ice applications and the swallowing of ice, with alkaline and sedative sprays. Local applications of menthol and cocaine are often indispensable to relieve the pain. The use of morphine is to be deprecated.¹ Daly² and others have recommended to apply to the neck large mustard poultices, which would by their revulsive action tend to change the internal erysipelas into an external one. If œdema of the larynx ensues, hypodermic injections of pilocarpine hydrochlorate from one-sixth to one-third grain, and scarifications of the œdematous tissues, may be tried. If these fail, tracheotomy must be resorted to.

PHARYNGITIS HERPETICA.

Synonymes.—Herpes of the pharynx; common membranous sore throat; aphthous sore throat; (benign) croupous angina.

This affection is comparatively rare; it is ordinarily preceded by a general feeling of illness and by fever from two to three days, during which time gastric disturbances may have simulated an entirely different ailment. All of a sudden the patient complains of sore throat of varying intensity. The submaxillary glands may be moderately swollen, pain may radiate to the nasal fossæ or the Eustachian tubes, and salivation is frequently profuse. At this stage the physician usually finds a white, membranous deposit on the soft palate and uvula, sometimes also on the tonsils, which latter are in all cases somewhat enlarged and inflamed. The affection is generally unilateral, but bilateral attacks have also been observed. Left to itself, it usually heals in from four to fourteen days. However, relapses may occur again and again, and the disease may become chronic. More serious sequelæ have also been observed, as ulcerous sore throat with perforation of the palate, extension of the membranes into the larynx, and genuine diphtheria developing out of common membranous sore throat (Trousseau).³

The membrane is, however, not the only essential feature of this affection, though it has contributed to give it one of its names. If we could see the throat in the initial stages, we might discover small vesicular eruptions, arranged in groups, on the soft palate, and sometimes on the tonsils. These vesicles soon become excoriated, to be covered by a plastic exudation of whitish color, consisting microscopically of a fibrinous net-work, in the meshes of which are embedded innumerable white, and very few red, blood-corpuscles, and epithelial detritus. These membranes are but loosely adherent, and may be pulled off readily with the forceps; in fact, sometimes, when loosened by themselves, they hang suspended from the soft palate like curtains. The vesicular stage, according to J. Solis Cohen,⁴ is

¹ See p. 255, on the use of morphine in throat-affections.

² Transactions of the Ninth International Medical Congress, Washington, D.C., 1887, vol. iv. p. 70.

³ Op. cit., p. 322.

⁴ Common Membranous Sore Throat, New York Medical Journal, March 23, 1889.

very rarely seen; so rarely, indeed, that its existence has by some been denied. At the outset of the affection there is frequently coexistent an herpetic eruption on the lips, the inner surface of the cheeks, and the tongue, while during the course of the pharyngeal affection eruptions of herpes may appear on the nose, the laryngeal mucosa, the prepuce, and the vulva. Sometimes after rupture of the vesicles a membrane does not form, and there remain small white or yellowish-white ulcers, which may be either circumscribed or confluent. This is the condition which, no doubt, has given rise to the synonyme of aphthous sore throat; and this latter designation gains significance in view of the statement made by Forchheimer,¹ that aphthæ in the mouth of children is probably nothing more nor less than an eruption of herpes.

Etiology.—A chill after exposure to cold is thought by many to be a causative factor. J. Solis Cohen² mentions as predisposing causes the influences of inefficient house-drainage and of contact with putrefying matter. The disease is also said to precede or to accompany many febrile conditions; and disturbances of menstruation have at times been held responsible for it.³ Some authors⁴ contend that the neuropathic origin of herpetic pharyngitis is well established, and consider it a herpes zoster of the trifacial nerve. Bacteriological examinations have thus far given negative results.

Treatment.—The disease is ordinarily benign and self-limited, and in many cases no active treatment is called for. Antiseptic mouth-washes and sprays may be advantageously employed, especially during the detachment of the membranes. Hypodermic injections of pilocarpine hydrochlorate have been highly recommended by Vialle.⁵ For the ulcerative (aphthous) condition above described, gargles of chlorate of potassium will prove beneficial. General symptoms, as fever, weakness, and severe pain, may require the treatment described for such conditions in previous sections. If rheumatic influences seem to have had a share in the production of the disease, the salicylates, colchicum, aconite, etc., are indicated. J. Solis Cohen⁶ advocates the daily application of diluted acids, and the internal use of iron, bark, nux vomica, arsenic, etc., in such persons as seem to have a special predisposition to this affection. The hygienic conditions, if at fault, should by all means be improved.

¹ Diseases of the Mouth in Children (Non-Surgical), Philadelphia, 1892, p. 35; The Etiology of Stomatitis Aphthosa, Philadelphia Medical News, November 28, 1891.

² Loc. cit.

³ Helmkampf, Diagnose und Therapie der Erkrankungen des Mundes und des Rachens, Stuttgart, 1886, p. 234.

⁴ Herzog, Ueber Herpes des Rachens, Pester Med.-Chirurgische Presse, 1890, No. 18 u. 19. Ollivier, Nouvelles Recherches sur la Pathogénie de l'Angine Herpétique, La Semaine Médicale, No. 37, 1884.

⁵ L'Actualité Médicale, August 15, 1890.

⁶ Loc. cit.

RHEUMATIC PHARYNGITIS.

Synonymes.—Rheumatic angina ; rheumatic sore throat.

This is an acute affection of the throat, resembling in its symptoms acute catarrhal pharyngitis, and occurs in persons who are otherwise affected with rheumatism. The attack may precede or follow a rheumatic seizure, muscular or articular, or it may occur repeatedly in rheumatic subjects without other contemporary manifestations of the diathesis.

The diagnosis in such cases must be based mainly upon the history of the patient, evolving the fact that we have to deal with a rheumatic subject, and upon the experience that the ordinary local treatment is of no benefit whatever, while a treatment directed against the diathesis quickly proves efficient. Trousseau¹ mentions as characteristic the rapidity with which the painful affection appears and "as if by enchantment" disappears again. In the beginning it is very seldom possible to distinguish between this and any other form of sore throat, unless the patient has been before under treatment for the same ailment. Sometimes the painful sensations are referred to the external muscles of the neck, and wry-neck may accompany or follow an attack. Fever may or may not be present. Generally in a few days the patient feels well again.

However, frequent recurrences are not uncommon, and after a number of them, or even without them, a chronic form of rheumatic sore throat may develop, as E. Fletcher Ingals² has pointed out.

Treatment.—Internally, sodium salicylate, salol, potassium bicarbonate, potassium iodide, extract of phytolacca, salophen, syrup of hydriodic acid, etc., are the remedies to be employed. Beverley Robinson³ recommends purgative medicines, alkaline diuretics, iron in small doses. Locally, soothing sprays or gargles, hot vapors, warm applications around the neck, sometimes, also, slightly astringent pigments (tannin with morphine), will be found useful. If we have to deal with a more chronic form of rheumatic sore throat, the same remedies are used, although their action is frequently not quite so prompt as in the acute form. In obstinate cases, especially where the small muscles surrounding the throat were extraordinarily painful, I have seen the best results follow the external application of the electric current (faradic as well as galvanic), or the use of massage, or of both together.⁴

¹ Op. cit., p. 334.

² Transactions of the Thirty-Eighth Meeting of the Illinois State Medical Society, 1888.

³ The Rheumatic and Gouty Diathesis as manifested in Diseases of the Throat, New York Medical Record, December 6, 1890.

⁴ M. Thorner, Chronic Throat Affections of Rheumatic Origin, Journal of the American Medical Association, May 10, 1890.

GOUTY SORE THROAT (ANGINA ARTHRITICA).

"By the term 'gouty sore throat' is meant the presence of distress in or about the pharynx or larynx, dependent upon the existence of gout in the system."¹ This, to be sure, does not exclude the existence of an ordinary sore throat in gouty subjects without its having anything to do with the diathesis. As to the frequency of gouty sore throat we find great diversity of opinion. Many authors deny its existence entirely. Morell Mackenzie² says that while "gout is the last resource of destitute diagnosticians," it cannot be denied that it does explain some obscure phenomena, and that he himself, in the course of a long experience, had met with a few cases. Harrison Allen³ and Beverley Robinson⁴ are inclined to think that in its milder forms gouty sore throat is often quite manifest.

Pain in the throat and intense hyperæmia are the principal symptoms. Sometimes the whole soft palate is oedematous, sometimes the uvula alone. The history of the patient and the examination of the urine, the total amount of uric acid being below the normal, will clear up a doubtful diagnosis. Harrison Allen⁵ mentions as a valuable, though not an essential, aid to diagnosis, the condition of the teeth. They are generally large, the antero-posterior diameter being especially exaggerated, and the enamel thick and of yellowish color. These peculiarities of the teeth are confined to the incisors, canines, and bicuspid. The crowns are often blunted, and a disposition exists for recession of the gums from the neck of the teeth.

Treatment must be essentially constitutional. Colchicum is considered of great value. Lithia preparations are largely used. Beverley Robinson⁶ recommends, as in the rheumatic sore throat, alkaline diuretics, purgatives (calomel, podophyllin, Carlsbad Sprudel salt), Turkish baths, physical exercise and friction, and iron. Errors of diet must be guarded against. Local applications must be of the most soothing character.

¹ Harrison Allen, On Gouty Sore Throat, Medical News, Philadelphia, 1888, p. 663.

² Gout in the Throat, Journal of Laryngology and Rhinology, 1888, p. 314.

³ Loc. cit.

⁴ Loc. cit.

⁵ Loc. cit.

⁶ Loc. cit.

ACUTE TONSILLITIS.

BY C. E. BEAN, M.D.,

St. Paul, Minnesota.

Synonymes.—Quinsy; cynanche tonsillaris; amygdalitis; phlegmonous sore throat; inflammatio tonsillarum; angina phlegmonosa; angina tonsillaris.

Definition.—An acute inflammation of the tonsil or tonsils, either superficial or extending into the parenchyma of the gland, affecting or not the lacunæ, and terminating in resolution, abscess, or chronic enlargement of the gland.

ETIOLOGY.

The causes of acute tonsillitis may be divided into *predisposing* and *exciting*.

Predisposing Causes.—An inherited tendency, especially in the strumous diathesis, rendering the subject liable to inflammatory attacks in any of the lymphatic glands, must be given a prominent place in the list of predisposing causes.

Age plays an important part in the production of this disease. It is chiefly a disease of adolescents and young adults, from fifteen to thirty years of age, but occurs most frequently between the ages of twenty and thirty. It is very rare in infants, or even in children under ten years of age, and the anatomical changes that have taken place in the tonsils by the time the subject has reached the age of forty render them less liable to acute inflammation. Still, no age is entirely exempt from it. Reid¹ records a case of suppurative tonsillitis in an infant seven months old; Browne² mentions a case of quinsy in a subject seventy-one years of age; and S. Solis Cohen³ records a case in a patient at the advanced age of eighty.

Influence of Sex.—It occurs more frequently among males than among females in the proportion of three to two, this being probably due to the fact that the occupations of men render them more liable to exposure and the exciting causes of the disease.

The most important factor in the etiology of acute tonsillitis is the rheumatic diathesis. It has been my habit for several years to question

¹ Archives of Laryngology, vol. i. p. 229, New York, 1881.

² Diseases of the Throat, 3d ed., p. 241, London, 1890.

³ Abscess of the Tonsil in an Octogenarian, Medical News, Philadelphia, February 16, 1884, p. 186.

closely those suffering from this disease who have come under my observation as to their personal and family history in regard to the prevalence of rheumatism or rheumatic affections, and in a large majority of cases—at least seventy per cent.—there has been a decided rheumatic history. This proportion may not exist in all sections of the country, but in this region, where rheumatic affections are prevalent, it is unquestionably the case. In some patients every attack of acute tonsillitis is invariably preceded by a slight attack of rheumatism, which passes away as the tonsillitis develops; in other cases the attacks of rheumatism and angina are simultaneous. Again, acute articular rheumatism is not infrequently preceded by an attack of acute tonsillitis. It is hardly necessary to argue this point, for, since attention to this phase of the disease was first directed by Lennox Browne, and afterwards more completely by C. Haig Brown,¹ it has been confirmed by almost every observer.

Enlargement of the tonsils, either congenital or the result of previous attacks of acute tonsillitis, predisposes to the disease, and it occurs much more readily in those who have once been the subject of an attack. This is especially shown when, from any cause, general ill health has been induced. Under these circumstances the slightest exposure will bring on an attack of acute tonsillitis.

Effect of Climate and Season.—Tonsillitis is far less prevalent in warm countries, where the changes in temperature are neither sudden nor marked. It also occurs most frequently in those months which are marked by cool, moist weather and sudden changes in temperature,—precisely the conditions under which rheumatic affections are the most prevalent.

Exciting Causes.—Usually the exciting cause of an attack of acute tonsillitis is exposure to wet and cold, causing a chill, though not infrequently it comes on suddenly and without any apparent cause: any disturbance of the animal economy in those who are especially susceptible by reason of previous attacks is sufficient to lead to the development of an acute inflammation in the gland. It sometimes occurs secondarily in the course of the exanthemata, as in cases of scarlet fever, measles, or small-pox, and also in cases of diphtheria. It may occur traumatically from the inhalation of irritating gases or the swallowing of acids, or from the impaction of foreign bodies, as fish-bones, fragments of tooth-picks or egg-shells, etc., in the substance of the gland. Mechanical injury of any kind to the parts, or the presence in the lacunæ of the tonsils of cheesy masses undergoing calcareous degeneration, frequently leads to an attack of acute tonsillitis.

Where both tonsils are affected simultaneously, Kingston Fox² believes it to be almost pathognomonic of the septic character of the inflammation. Septic tonsillitis is usually the result of the inhalation of sewer-gas or the drinking of impure water, generally attacking several or all of the members of the family at the same time.

¹ Tonsillitis in Adolescents, London, 1886.

² Transactions of the Medical Society of London, vol. ix. p. 255.

SYMPTOMS.

The symptoms of an acute tonsillitis are both constitutional and local, varying according to the intensity of the attack and the character of the inflammation.

The onset of an attack is usually preceded by general malaise, sometimes for twenty-four hours, followed by pyrexia. The temperature at the end of the first day of fever may be 103.5° F., and at the end of forty-eight hours may reach 105° F., this usually being the maximum. In the simple and lacunar variety the temperature does not range as high as in the parenchymatous form of the disease, nor does it usually reach as high a point in those who are subject to the attack as it does in those who are affected for the first time.

Accompanying or quickly succeeding these symptoms there is a sense of fulness and stuffiness in the throat, accompanied by more or less pain, and inducing frequent acts of deglutition. The heat and soreness of the throat rapidly increase in severity until the pain is intense. The tonsil becomes swollen into an irregular, tumid mass of a vivid red color, with the lacunæ filled with a viscid yellowish-white secretion. This is usually limited to one tonsil, though occasionally both tonsils are affected simultaneously. The inflammation is seldom confined to the tonsil: the base of the tongue, the pharynx, the uvula, and the soft palate, all partake of the local inflammation. If there be a prevailing naso-pharyngeal catarrh with slight inflammation or enlargement of the pharyngeal tonsil, this structure at this time becomes inflamed and swollen to an unusual degree, and its lacunæ are filled with the same thick, yellowish-white secretion as is observed in the lacunæ of the faucial tonsil; and to this swollen and inflamed pharyngeal tonsil is due in a great measure the intense, excruciating, lancinating pain in the ear that is so prominent a feature in many of these cases. The inflammation of the pharyngeal tonsil is frequently of the most stubborn character, followed by ulceration of the parts and requiring special medication after the acute attack of tonsillitis has entirely subsided. Hearing is often impaired, due to the extension of the inflammation to the Eustachian tube and middle ear, and to the closure of the Eustachian tube by the swollen pharyngeal tonsil, and the pressing back upon the mouth of the tube of the posterior palatine arch by the swollen faucial tonsil. This is sometimes accompanied by severe and annoying tinnitus.

Deglutition is seriously interfered with, on account of the pain, and, in cases where both tonsils are affected, by reason of the narrowing of the faucial orifice. This pain is increased when the anterior palatine arch is inflamed and put upon the stretch, and when the inflammation extends to the posterior palatine fold the pain is so intense and excruciating that deglutition even of the blandest and most soothing liquids becomes almost an impossibility, and the saliva is allowed to dribble from the mouth. Attempts at swallowing liquids frequently result in the fluid being ejected into the

nose and out through the anterior nares, or if swallowed it is apt to get into the larynx, causing the most distressing attacks of strangling. It is in these cases that pain in the ear is the most severe, accompanied by pulsations, often the premonitory symptoms of suppuration. The senses of smell and taste are impaired, and the free passage of air to the lungs is impeded by the obstruction caused by the swelling of the pharyngeal tonsil as well as by that of the faucial tonsils. The voice is affected even in those cases where the inflammation does not extend to the larynx; the speech is thick and guttural, and frequently it is easy to diagnose a case from the attempted articulation and enunciation alone. This difficulty in speech is due not only to the swollen and inflamed condition of the tonsils, but also to the extension of the inflammation into the connective tissue and the glandular enlargement at the angle of the jaw interfering with the mobility of the parts. The pain is not only in the throat and ear, but extends to the muscles at the sides and back of the neck, and into the temporo-maxillary region. There is cephalalgia, and also pain in the lumbar regions, extending down the limbs. There is no cough, but a constant effort to clear the throat of the secretion which accumulates there in great abundance. The uvula is sometimes swollen and œdematous, and adheres closely to the affected tonsil. The urine is of high specific gravity, highly colored and scanty. The submaxillary glands are swollen and inflamed and sensitive to manipulation, and occasionally undergo suppuration. All of these symptoms are not present in milder cases, being proportionate to the severity of the attack.

In the simple variety the attack usually terminates by resolution in four or five days, but in the parenchymatous variety it lasts longer, and, unless resolution takes place in about ten days, slight rigors occur, announcing suppuration. The secretion becomes more abundant and thickened, the distress is increased, and severe lancinating pulsating pains supervene, lasting until the abscess bursts or is opened artificially, when immediate relief follows. In some cases the abscess does not escape into the pharynx or mouth, but into the larynx, or it may burrow beneath the pharyngeal muscles and open externally at the angle of the jaw, or it may descend along the plane of connective tissue into the mediastinum or lungs.¹

The deeper-seated abscesses cannot be detected before they rupture, unless their presence is suspected from the constitutional disturbances and incision into the tonsil is made upon this supposition.

Infectious tonsillitis may result in abscess in some contiguous part as a sequela to the attack, as in one case of my own where retro-pharyngeal abscess followed an attack of tonsillitis lasting only three or four days, and in another case related to me by a physician where abscess of the cheek followed the attack of tonsillitis.

¹ J. Solis Cohen, *Pepper's System of Medicine*, vol. ii. p. 383, Philadelphia, 1885.

PATHOLOGY AND MORBID ANATOMY.

Wagner¹ recognizes five different varieties of acute tonsillitis,—viz., (a) simple or superficial,—a pure catarrhal inflammation of the mucous membrane of the tonsil; (b) lacunar or follicular, appearing in connection with the simple form and affecting the lacunæ of the tonsil, which become filled with a thick whitish-yellow secretion; (c) parenchymatous, characterized by a high grade of hyperæmia and serous infiltration, usually preparatory to the formation of an abscess; (d) tonsillitis with abscess,—tonsillar abscess,—occurring chiefly in young adults, and at the same time with one of the previously-mentioned inflammations; (e) peri- or retro-tonsillar abscess, usually involving only one tonsil, and, when the abscess is formed in the connective tissue surrounding the tonsils, most frequently between the tonsil and the affected anterior palatine arch.

Clinically and practically there are only two varieties,—the superficial and the deep or parenchymatous form. The rest are simply differences in degree, and the simplest form originally may develop into the parenchymatous and end in abscess. The morbid condition may range from a simple superficial inflammation of the mucous membrane, attended with only slight pain and odynphagia, with no swelling and an absence of pyrexia, to the variety commonly and erroneously known as “quinsy,” where the gland is enormously swollen, the lacunæ filled with broken epithelium, pus, and micrococci, terminating, despite all medical efforts to the contrary, in abscess. It is the exception to find one case developing only one characteristic; more often two or three of the so-called varieties are present.

An attack terminates in complete resolution (which is rare), in resolution where the gland remains partially hypertrophied, or in abscess, the abscess usually rupturing, if left alone, at the upper and anterior part of the tonsil near the arch of the palate. In one case seen by me, at the termination of the attack the abscess had ruptured through the anterior palatine arch.

Lewis² makes the following distinctions between tonsillitis in rheumatic subjects and tonsillitis from any other cause:

(a) In rheumatic tonsillitis the inflammation is more marked in the peri-tonsillar connective tissue.

(b) In rheumatic tonsillitis the inflammation is less prone to suppurate, and if suppuration takes place, spontaneous discharge of the pus is certainly delayed.

(c) Subacute attacks with a moderate-sized gland are more frequently than not of rheumatic origin, particularly when the sanitary surroundings are good.

¹ Ziemssen's *Cyclopædia*, vol. vi. p. 911 *et seq.*

² Notes on Tonsillitis and Tonsillotomy, *British Medical Journal*, London, September 15, 1888, p. 614.

(d) In the rheumatic type the induration and thickening of the adjoining tissues are more marked than in those cases produced by other causes.

In the same article is the report of a microscopic examination of both varieties by Dr. Crooke, in which he says,—

“Microscopic investigation presents some points of difference between the tonsillitis of rheumatic origin and simple chronic hyperplasia. In the enlarged tonsil of rheumatic origin the changes are more active, so as to form almost a subacute variety. There is considerable cellular proliferation in the lymph-follicles, and also infiltration of the fibrous and retiform tissue, especially of the peritonsillar connective tissue, where the cell-infiltration is prominent in the adventitia of veins and small blood-vessels. Amidst the lymphoid cells numerous germinative or ‘keim’ centres are found: these have been described by Flemming and his pupils in hyperplasia of the tonsils and similar lymphoid follicles in other parts of the body. In places the leucocytic infiltration of the epithelial covering is so intense as to totally obscure the structural details of it, overreaching certainly the bounds of leucocytic infiltration of the epithelial covering described by Stohr as a normal condition. The crypts are often found filled with mucus- and pus-cells. There is no necrosis, as is observed in the acute tonsillitis accompanying the acute specific febrile diseases; but it is easy to suppose that such rheumatic tonsils are especially prone to acute attacks, and then liable to suppuration. No organisms were found in these tonsils.

“Regarding the chronically hyperplastic tonsils, the connective tissue and supporting stroma were much less infiltrated with cells and more fibrous in character. The hyperplasia seemed to be limited to pre-existing lymphoid follicles, some of which were enormously enlarged and showed the clear germinating centres, where the nuclei were larger and polymorphous and evidently in active proliferation. But the smaller and younger germinating centres seen in such numbers in the rheumatic tonsil were much fewer here, neither was there such intense leucocytic infiltration of the covering epithelium. The lumen of the crypts was considerably narrowed by the projection beneath the epithelium of the hypertrophied lymph-follicles.”

DIAGNOSIS.

The diagnosis of acute tonsillitis can frequently be made from the appearance of the patient and his attempts at speech. There are a peculiar care-worn, suffering appearance and thick guttural articulation characteristic of this disease. Inspection of the parts, if that be possible, should be sufficient to set at rest any doubts as to the character of the disease. The tonsil affected is swollen and red, the lacunæ filled with a yellowish-white secretion, and the breath fetid; the tongue is coated with a dark-brown fur. The uvula may be swollen and œdematous, and adheres closely to the affected gland; the arches of the palate, especially the anterior, are swollen and inflamed, the inflammation extending over the back wall of the pharynx, which is sometimes covered with swollen and inflamed folli-

cles, giving the appearance of a folliculous pharyngitis. All these conditions ought to render the diagnosis plain. Still, mistakes have occurred and will occur. It has been especially mistaken for diphtheria, carcinoma, sarcoma, syphilis, and the sore throat of scarlatina. It is most frequently mistaken for diphtheria, notwithstanding the difference in the subjective and objective symptoms. In one instance the same patient was exhibited by two lecturers in clinical work in a hospital to the same class on the same day as a case of lacunar tonsillitis and a case of diphtheria. This error in diagnosis has often led to the recommendation of some remedy for the relief of diphtheria when the case was only one of lacunar tonsillitis, which fact accounts for the large number of remedies that have been published from time to time for the relief of diphtheria, only to lead to renewed disappointment.

In tonsillitis the secretion is limited to the tonsil itself, is not membraniform, can be easily wiped off, and does not leave a bleeding or ulcerated surface; whereas in diphtheria the pharynx, both tonsils, and the soft palate have patches of white membrane firmly adherent, which tears off from the surface in strips, leaving a bleeding and ulcerated surface.

Diphtheria may follow closely upon an attack of tonsillitis, but it will be found to follow distinctly the history and course of diphtheria occurring primarily, independently of the tonsillitis.

From the *sore throat of scarlatina* without eruption it is distinguished by the flushed face, the characteristic enlargement of the papillæ of the tongue, and the fact that in scarlatina both tonsils are simultaneously affected.

From *syphilis* it is differentiated by the history of the disease, the "Dutch garden symmetry" of the inflammation, and the destructive ulceration.

It has been mistaken not infrequently for *carcinoma* and *sarcoma*; but a careful watching of the progress of the disease will soon correct any error into which the physician has been led. In a case of my own, in a subject thirty-nine years of age, male, where acute inflammation had taken place in both tonsils, that were previously hypertrophied, a competent microscopist after two examinations of specimens removed from the tonsils pronounced the disease a "round-celled sarcoma, a very rare growth in this locality." Notwithstanding this, the tonsils entirely disappeared in six months under a course of iron and arsenic.

PROGNOSIS AND DURATION.

The prognosis in a case of acute tonsillitis, outside of complications, is always favorable. Cases of death have been reported, and while these have been due entirely to accident, such as the bursting of an abscess and the escape of the pus into the larynx, causing suffocation, such a fact should lead to a certain amount of reserve in our prognosis. Death may occur from oedema of the larynx. During an attack of tonsillitis with retro-

tonsillar abscess, occurring to the writer, there was so extensive an œdema of the corresponding ventricular band as almost entirely to fill the calibre of the larynx, causing great difficulty in breathing and spasmodic suffocative attacks, necessitating scarification of the part, and sometimes the serious consideration of tracheotomy. Another accident that may cause death is hemorrhage on the bursting of an abscess; or it may occur from exhaustion in debilitated persons in whom, one tonsil having been affected and the attack having terminated, the opposite gland becomes the seat of a parenchymatous inflammation resulting in an abscess.

Gangrene of the tonsil as a termination to an attack of tonsillitis has been noticed, though it is very rare, and occurs only in the parenchymatous variety of the disease.

There is usually some hypertrophy of the tonsil left after the acute inflammation has subsided. Especially is this the case if the inflammation has been parenchymatous. This is particularly true of scrofulous subjects.

The simple or superficial form of the disease runs its course in four or five days. In the parenchymatous variety it lasts longer, generally from a week to ten days; but where the second tonsil becomes affected after the attack in the first one has terminated, the inflammation may last for three or four weeks.

TREATMENT.

The first indication in an attack of acute tonsillitis is to give a cathartic sufficient to clear the bowels entirely, and this is to be continued in a milder manner during the entire attack. Mild cases of the simple form of acute tonsillitis where the lacunæ are not involved require very little other treatment. Usually all that is necessary is a compound rhatany lozenge, composed of two grains of extract of rhatany and one-sixth of a grain of extract of opium, with eighteen grains of currant paste, slowly dissolved in the mouth every two or three hours. In the severer forms other and more active medication is necessary. Tincture of aconite in drop doses every fifteen minutes or every half-hour for two or three hours is of benefit in controlling the fever and lessening the pain.

Guaiacum in the form of a lozenge, as first recommended by Morell Mackenzie,¹ has not given the satisfaction claimed for it; besides, it is difficult to administer in this form,—first from the difficulty of deglutition, and secondly because of the increased secretion it causes in the pharynx, not the least distressing of the symptoms in the course of the disease. It is much better given in the form of the ammoniated tincture, in a gargle.

Gargling is difficult with most people at all times, and with patients suffering from tonsillitis it amounts to an impossibility. One of the most soothing applications is composed of a mixture of the ammoniated tincture of guaiacum, one part, and syrup of wild cherry, three parts, applied to the

¹ Diseases of the Throat and Nose, vol. i. p. 57, London, 1880.

tonsil by means of a brush or cotton wad every half-hour or hour. This mixture will also prove beneficial taken internally in the dose of a teaspoonful in half a glass of milk every hour or two. Small pellets of ice held constantly in the mouth prove soothing and beneficial, causing diminution of the heat and inflammation in the tonsil and pharynx.

Lemonade with the addition of sweet spirit of nitre keeps the throat clear of phlegm and tends to reduce the fever, besides being grateful to the patient as a drink.

If the lacunæ are filled, they should be carefully cleaned out by means of a small curette: if necessary, this can be done under the use of cocaine, but this drug should be used as little and as carefully as possible, for the subsequent drying of the palate and pharynx makes it objectionable to the patient. Still, under some circumstances, as, for instance, when it is impossible to administer any nourishment, the use of cocaine enables the patient to swallow fluids with considerable ease.

In the parenchymatous form, where there is much swelling and pain in the parts, local scarification of the tonsil often gives immediate and considerable relief. A free incision should be made, rather than a number of points. In the event of there being a deep-seated abscess we by this means open it, and, if there be no pus, the abstraction of blood relieves the tension of the part and hastens resolution. The flow of blood should be encouraged by gargling with warm water.

General blood-letting is of no benefit, and should never be practised: the plan of treatment should rather be supporting.

Local application of the solid stick of nitrate of silver comes to us so highly recommended¹ as to command respect, but in my hands it has had a tendency to increase the pain and to add to the already existing inflammation, rendering deglutition still more difficult.

Medicated vapors containing compound tincture of benzoin, fluid extract of hops, paregoric, or conium, are soothing local applications.

Antipyrin, in doses of from seven and a half to ten grains every three to four hours, will aid materially in controlling the pain and inducing sleep.

The remedy *par excellence* in the treatment of this disease, and the one in which I place the most confidence, is salicylate of soda. This is given, for an adult, in fifteen-grain doses every three hours. Usually permanent relief from the pain will be obtained in twelve hours. The only objection to its use is its liability to produce nausea, but this can in a measure be obviated by administering it with ordinary milk, or mixed in milk of magnesia in the proportion of fifteen grains to the tablespoonful. So successful has this remedy been in the treatment of this disease that I invariably commence its use as soon as the patient has been seen, even though I obtain no rheumatic history, this, in conjunction with antipyrin, being

¹ J. Solis Cohen: Diseases of the Throat and Nasal Passages, New York, 1879, p. 96.

in a large majority of cases all that is necessary, while in cases that are decidedly rheumatic the relief is sometimes instantaneous. Solid food is to be abstained from for the first day or two, but ice-cold milk can be taken *ad libitum*.

When symptoms of suppuration are manifest the treatment should be directed towards hastening this process as rapidly as possible. To this end hot poultices of flowers of hops should be kept constantly applied to the neck, and the patient should make continuous use of one of the medicated inhalations previously mentioned. As soon as the pus has formed, the abscess should be opened, and not allowed to rupture of itself, for in this way we save the patient two or three days of suffering, besides preventing a possible accident, and help preserve his strength in the event of the other tonsil becoming affected. The abscess is opened by means of a long-handled bistoury with a cutting edge an inch long, or, if longer, it should be protected by wrapping the rest of the blade in cotton; the incision should be made with the cutting edge of the blade directed towards the interior of the mouth, so as to avoid the wounding of the internal carotid artery from any untoward movement of the patient, and at the point of apparent rupture, this being usually, as stated above, at the upper and anterior surface of the tonsil, near the anterior palatine fold. In one patient that was under my care, several years ago, for another affection of the throat, there were visible on the back wall of the pharynx, just back of the right tonsil, the pulsations of an artery of sufficient magnitude to cause an alarming hemorrhage if cut, and she was cautioned, in the event of an attack of tonsillitis, to inform the attending physician of this fact.

When the connective tissue about the angle of the jaw is so swollen as to prevent the opening of the mouth sufficiently wide to enable the operator to obtain a distinct view of the parts, the incision must be made under the guidance of the finger where this is possible. The flow of pus should be encouraged by gargling with water mixed with peroxide of hydrogen. In making incisions into the tonsil, care must be taken to avoid wounding the anterior arch of the palate, for this entails considerable loss of blood, which does no good, and increases in great measure the pain, suffering, and difficulty of deglutition.

In debilitated subjects active supporting measures are required, both during and subsequent to the attack, such as quinine, arsenic, and alcoholic stimulants.

If both tonsils are affected simultaneously the swelling may so encroach upon the breathing-space as to require abscission of one or both tonsils at once, or the performance of tracheotomy.

Prophylactic Treatment.—Persons who are subject to repeated attacks of acute tonsillitis should have the tonsils removed. This may be done by abscission or by means of the galvano-cautery.

CHRONIC PHARYNGITIS.

BY E. FLETCHER INGALS, M.D.,

Professor of Laryngology and Practice of Medicine in Rush Medical College; Professor of Diseases of the Throat and Chest in Woman's Medical College; Professor of Laryngology and Rhinology in Chicago Polyclinic, and Laryngologist to the Presbyterian and St. Joseph's Hospitals, etc.
Chicago, Illinois.

Synonymes.—Clergyman's Sore Throat, Chronic Follicular Pharyngitis, Granular Sore Throat; sometimes known as Hospital Sore Throat.

There are three varieties of this disease, which have been termed hypertrophic, atrophic, and exudative. It occurs most frequently in damp and chilly climates, and is oftener met with in persons of delicate constitution than in those more robust. It is probably the most frequent of all chronic disorders of the throat.

The affection is characterized by hyperæmia and swelling of the mucous membrane, sometimes in patches, sometimes uniformly over the pharynx, with more or less hypertrophy of the mucous and submucous tissues. Uncomfortable sensations of pricking or dryness, or a desire frequently to clear the throat, are generally experienced. Usually viscid mucus in considerable amount collects upon the pharyngeal wall, which, according to its tenacity, is removed with greater or less difficulty, especially in the early morning or directly after meals. In some cases there is general hyperæmia of the pharynx, with thickening of the whole mucous membrane, which is likely to be thrown into longitudinal folds in consequence of the increased amount of tissue. This may be termed the hypertrophic variety of the disease; but usually in this variety the brunt of the inflammation is expended upon the follicles or upon the mucous membrane immediately about them, and the thickened congested membrane becomes studded with several round or oval prominences, elevated one or two millimetres above the surrounding surface, and varying from three to eight millimetres in diameter. These mark the site of mucous follicles.

They are usually of a deep pink or reddish color, but sometimes, especially in the anæmic or when some of the secretions have been retained in the follicle, they are of a yellowish hue. Frequently they present the appearance of small blisters with gelatinous contents. Often two or three of these follicles running into each other form prolonged welts upon the surface, usually observed immediately back of the posterior pillar of the fauces. Two or three superficial veins are often found enlarged, and often they seem to terminate in the diseased follicles. These eminences consist of a pro-

liferation of lymphatic tissue about the ducts of the mucous glands. When the inflammation continues for considerable time, the consequent hyperplasia of connective tissue is followed by inevitable contraction, which by cutting off circulation finally results in atrophy of the mucous membrane of greater or less extent; the enlarged follicles may then disappear, or some of them may remain, being rendered more prominent by the thin, white, atrophied membrane about them. In advanced cases the mucous membrane, covered with secretions and marked by yellowish-white streaks due to atrophy, has the appearance of a granular surface bathed with pus.

In the exudative form the inflammation seems to be confined largely to the follicles, which become filled with cheesy secretions and present much the appearance of the lacunæ in chronic follicular tonsillitis. This variety is much less frequent than the hypertrophic form, and the atrophic variety in regard to frequency stands about midway between the two. Not infrequently in the latter variety, and sometimes also in the hypertrophic form, the secretions become very scanty, and the pharyngeal wall presents a dry, glazed appearance, which has given rise to the term *pharyngitis sicca*.

Etiology.—Chronic pharyngitis is frequently due to continuous irritation from the inhalation of atmosphere vitiated by dust or smoke, and it often results from exposure to cold or damp. The hypertrophic variety, particularly that in which the hyperæmia and swelling are uniform, is frequently caused by the excessive use of tobacco, particularly by inordinate smoking, or by the habitual use of alcoholic stimulants. Occasionally inflammation of this sort appears to have resulted from the inhalation of acid fumes,—for example, those to which tinsmiths are exposed in soldering. Over-use of the voice in badly-ventilated rooms or in the open air is undoubtedly a frequent cause, and the free use of condiments appears to induce the inflammation in some individuals. The affection is often attributed to digestive disturbances, especially those in which acid eructations from the stomach are common. Not infrequently it seems to result from the rheumatic or gouty diathesis; but probably the most common cause of this inflammation is obstruction to nasal respiration by hypertrophy of the turbinated bodies, giving rise to mouth-breathing. In these cases it appears probable that some change in the innervation of the tissues, similar to that occurring in the nasal cavities, is in part responsible for the pharyngeal inflammation; for in many patients in whom nasal respiration is completely obstructed by the presence of mucous polypi constant mouth-breathing does not excite inflammation of the pharynx, and it has appeared to me that pharyngitis is much less frequently associated with obstructed nasal respiration due to deflection or exostosis from the septum than with those obstructions resulting from hypertrophy of the turbinated bodies.

The exact manner in which inflammation of the pharynx is caused by mouth-breathing probably varies in different cases. In some it appears to be due to the direct impact upon the surface of irritating particles or of dry or cold air, but in many the inflammation apparently originates in

the vault of the pharynx, where it has been ascribed to rarefaction of the air during each inspiration, the consequent congestion of the blood-vessels after a time eventuating in chronic inflammation. The frequent occurrence of the disease in different members of the same family leads to a belief in its hereditary origin in some instances. It is sometimes a sequel of the eruptive fevers. Among the uncommon causes may be mentioned mental depression and congestion of the portal venous system; but the majority of cases, whatever the exciting causes be, undoubtedly result from frequent recurrence of acute pharyngitis.

Symptomatology.—There is usually a history of frequent acute attacks which finally terminate in the chronic disease, perhaps without attracting the patient's attention, but finally discomfort is experienced in the throat, which may consist of pricking sensations or simple dryness, but is sometimes described as a burning pain. These sensations may be continuous or may occur only at intervals, but are commonly relieved by the taking of food, probably in consequence of the moistening of the parts by increased secretion. Not infrequently the pricking sensations lead the patient to believe that a splinter, bone, or other foreign body has become lodged in the throat, and some experience the sensation as of a hair or bristle upon the surface. Others complain of a lump in the throat very similar to the globus hystericus. These sensations are sometimes referred to a particular part of the pharynx, or they may change from place to place, but usually the patient is unable to locate them. While in most instances the uncomfortable sensations in the throat are relieved by the act of swallowing, they are sometimes more pronounced at this time than at others. In these latter cases the sensations frequently appear to result directly from the lodgement of dry secretions in the follicles, having much the effect of a foreign body. In some the swallowing of liquids is painful, in others the swallowing of solids gives rise to most discomfort. One of the most common symptoms of the disease is an uncomfortable sensation in the throat produced by swelling of the mucous membrane or by tenacious secretions upon its surface, which causes the patient to frequently hawk and attempt to clear the throat. This is especially noticeable in the early morning or directly after breakfast.

In many cases extension of the inflammation to the larynx causes alteration in the voice, which readily becomes hoarse after prolonged use; this, indeed, is one of the most common symptoms of the disease, but it may not be noticed except in those whose vocations compel them to use the voice excessively. In many cases the voice is simply muffled, there being no actual hoarseness, but sometimes complete aphonia results, particularly during acute exacerbations of the inflammation. These are most likely to occur during the colder months of the year, or during the sudden changes of spring and fall.

When the inflammation has extended to the larynx, little masses of tenacious mucus are frequently expectorated, and in some cases the sputum

becomes muco-purulent, and is occasionally streaked with blood; this is more apt to result when the trachea is also inflamed. In many patients the secretions which form in the naso-pharynx gradually gravitate to the oropharynx, or even to the larynx, and may be seen upon inspection adhering to the surface. These are usually very tenacious, and often become dry and discolored by the inhalation of dust. The tongue is commonly coated, the bowels are constipated, and in many patients symptoms of gastric indigestion are also present. Not infrequently these patients are found debilitated; but the constitutional symptoms in such cases are probably the result of the causative disease rather than of the pharyngeal inflammation.

Upon inspection the throat will be found more or less congested, with uniform thickening, or here and there swollen patches, and, in some instances, enlargement of one or more of the superficial veins. In nearly all cases one or more of the follicles will be found prominent, and in most cases several of these have become joined together so as to form a prolonged welt just back of the posterior pillar of one or the other side. When the inflammation is confined mainly to the follicles, about them is usually a narrow zone of congestion. In the exudative form of the disease yellowish masses appear at the orifices of the follicles, but seldom in more than two or three places upon the pharynx, though in the same individual there will usually be found several similar masses at the orifices of the lacunæ in the tonsils, and they may also be present in the follicles upon the base of the tongue. Cohen speaks of small ulcers in this variety of disease, but they are certainly very infrequent. Commonly the tonsils are hypertrophied and their follicles diseased. The uvula is often relaxed, thickened, elongated, and discolored, and the larynx is often much congested.

In the naso-pharynx the process of inflammation is usually present, the mucous membrane being thickened and congested, sometimes partially covered with dry, decomposing crusts, at other times by abundant muco-purulent secretions; but inflammation is not always present in this locality, and it may be confined to the oro-pharynx or laryngo-pharynx. In not a few instances the disease appears to have originated in the naso-pharynx and to have run its course completely in this position before the patient comes under observation. In making the rhinoscopic examination submucous thickening at the sides of the vomer is frequently discovered, and the posterior ends of the turbinated bodies are often found enlarged. Sometimes the pharyngeal bursa is found to be diseased, and, especially in children, Luschka's tonsil is often hypertrophied.

Diagnosis.—Chronic pharyngitis is not likely to be mistaken for any other disorder excepting *syphilitic disease of the throat*, which sometimes occasions uniform hyperæmia and slight swelling, but with no diagnostic features. In such instances an accurate diagnosis may be impossible in the beginning. Usually syphilis is only manifested in the throat in the secondary or tertiary stage, and in these the mucous patches of the secondary or the deep ulceration of the tertiary period commonly render the diagnosis

comparatively plain. It must not be forgotten, however, that in exceptional cases ulceration occurs in chronic pharyngitis which might be mistaken for the syphilitic lesion. The diagnosis in such instances must depend largely upon the history and the results of treatment, together with the appearance of the ulcer, which, to the experienced eye, is seldom deceptive. The ulcer in chronic catarrhal inflammation is not covered by the thin, whitish membrane or surrounded by the narrow areola of congestion which marks the mucous patches, and it has not the elevated, hardened edges, with the deep excavation and foul base, of the tertiary ulcer.

By the inexperienced, chronic follicular pharyngitis might be confounded with *tubercular ulceration* of the pharynx, but in the latter the superficial character of the ulcers and their irregular and ill-defined borders are generally sufficient to distinguish them from the disease under consideration. In others the history of the case, the severe pain in the throat, and the marked constitutional symptoms accompanying tubercular lesions will establish the diagnosis.

Prognosis.—Chronic pharyngitis, if neglected, may continue for months or years. In many cases the inflammation extends to the middle ear, causing throat-deafness. Usually the larynx also becomes involved, giving rise to changes of voice or to complete aphonia. It may finally terminate in the atrophic variety, which is far more troublesome to the patient than the hypertrophic form. The distinctly follicular form of the disease is usually more easily cured than diffused hypertrophic pharyngitis, except in those cases where the follicles are prone to become filled with cheesy secretions, giving rise to what has been termed the exudative form of the disease. This latter, without appropriate treatment, is the most troublesome form of pharyngitis; it is less liable to spontaneous recovery, and is generally considered the least responsive to treatment.

Treatment.—Patients suffering from chronic pharyngitis should be especially careful to avoid all those exposures which are likely to aggravate the inflammation or favor its continuance. In many cases we will find faulty digestion and elimination, which should be corrected by stomachic or bitter tonics, eliminants, digestive agents, and alteratives.

The condition of the bowels should be carefully regulated, and in many instances a course of saline diuretics will be especially beneficial, particularly in those patients with a rheumatic diathesis. A prolonged course of arsenious acid in appropriate doses is sometimes very serviceable. If the patient suffers from dyspeptic symptoms, the following prescription will sometimes prove of great advantage :

R Piperinæ, gr. $\frac{1}{4}$;
 Berberinæ hydrochloratis, gr. i;
 Ext. nucis vomicæ, gr. $\frac{1}{3}$;
 Acidi salicylici, gr. ii;
 Papainæ (carica papaya), gr. iii.—M.
 Sig.—Enclose in capsule.

One of these should be given before meals, and, if they are not sufficient to prevent all discomfort after eating, another may be given one or two hours afterwards. When the patient complains of costiveness, it is well to add the extract of cascara sagrada in sufficient amount to accomplish the desired result, and when indicated small doses of arsenious acid, colchicum, or other constitutional remedies may be given in the same combination.

Though much benefit will usually result from attention to the digestive organs, local treatment is most important; for this purpose silver nitrate has been used from time immemorial, and often with much benefit, but the treatment is harsh and in a considerable number of patients gives rise to distressing spasms of the glottis. There is also a general impression among the laity that the subsequent condition of the throat when treated by this agent is worse than before the treatment was instituted, although at the time the improvement is frequently marked. Whether or not there is ground for such a belief I am not prepared to say, but the effects of the treatment are so extremely unpleasant that in the majority of cases I prefer other measures, usually quite as effective, and less unpleasant. Silver nitrate may be employed in solution or in the solid form. The solution is best applied by means of a large swab of absorbent cotton, which having been thoroughly moistened is passed quickly with one or two strokes from below upward over the whole surface. If the solid caustic is used, only a small area should be touched at any treatment. In the follicular variety of the disease, when the follicles are not deeply congested and the surface of the pharynx continues moist, I have obtained great benefit from a powder composed of one part of berberine hydrochlorate to two parts of acacia, two or three grains of which should be thrown into the vault of the pharynx two or three times a week.

Powders applied in this way sometimes remain for hours in the nasopharynx, gradually working their way down over the oro-pharynx, thereby exercising a prolonged effect upon the mucous membrane. Whatever application is made to the pharynx or naso-pharynx, a weak preparation should at first be employed, because the susceptibilities of patients are very different; and in no case should the remedy cause severe pain for a great length of time, except perhaps the silver nitrate, which sometimes appears to be more beneficial if applied in a solution strong enough to give the patient discomfort for three or four hours. In many cases, particularly of a mild grade of chronic inflammation, the frequent use of troches of krameria, compound troches of krameria, or other astringents will be found beneficial. In the more severe and obstinate forms of chronic pharyngitis stronger applications must usually be made. These are most conveniently made by means of the spray. The solutions which are generally found most beneficial are those of copper sulphate, ten to twenty grains to the ounce; zinc chloride or zinc sulphate, ten to thirty grains to the ounce; mercury bichloride, one-half grain to the ounce; and alum, twenty to forty grains to the ounce of water. Preparations of iron or other astringents

may be used with similar effect, although the remedies just mentioned have seemed to me more satisfactory. In nearly all cases the inflammation extends at the same time to the naso-pharynx, and therefore, as a rule, applications should be made to it whenever the oro-pharynx is treated; but in making applications to the vault of the pharynx weaker solutions should always be employed, because of the greater sensitiveness of the part as well as the possible danger when strong remedies are used of exciting inflammation of the nares or Eustachian tubes. During the intervals between treatments it is best for the patient to use either astringent troches or mild astringent gargles two or three times daily; but in some cases atomized fluids of about one-half the strength of those employed by the physician may be used by the patient himself with better satisfaction.

When the follicles are much enlarged, no form of treatment is likely to prove curative until they have been reduced. This may be effected by such caustics as silver nitrate, chromic acid, or London paste, which should be applied accurately to the follicle and not to the surrounding membrane. Not more than two or three follicles should be thus cauterized at one sitting. The application should be repeated after four or five days, provided the soreness from the former cauterization has already disappeared. Silver nitrate applied to the surface of these follicles is of very little avail; but if the follicle is split open with a knife and the pointed stick of silver nitrate crowded into it the result is sometimes satisfactory, though usually chromic acid or London paste is more effective. Some authors recommend curetting the follicles, followed by cauterization of their bases, but this is seldom necessary if the caustic is of sufficient strength and accurately applied. The actual cautery may be employed for destroying these follicles, but it is difficult to use because of the rapidity with which its heat is lost and the liability of touching surrounding parts during its application. The galvano-cautery is by far the best instrument for the purpose, for with it the electrode may be accurately applied cold, the current turned on for a second, the follicle cauterized, and the wire allowed to cool again before the instrument is removed from the mouth.

In many cases enlarged blood-vessels will be seen running into and apparently terminating in the enlarged follicle, and in other cases several enlarged veins are visible upon the surface. In either instance these blood-vessels must be destroyed before a cure is likely to be effected. This may be readily done by the galvano-cautery point, or the vessels may be cut across with a knife and cauterized by a pointed stick of silver nitrate with similar results. The next day after cauterization of the pharynx with the galvano-cautery a whitish pellicle is observed over the burn, which may possibly extend for four or five millimetres on each side, appearing very much like a diphtheritic patch. This remains from five to ten or twelve days, the time depending upon the rapidity of the reparative process, which will be influenced by the patient's general condition, and sometimes apparently by the atmospheric surroundings.

The cases of chronic pharyngitis in which there is diffused inflammation and thickening without notable enlargement of the follicles are usually very difficult to cure. In these all sources of irritation must be carefully removed. To this end it will sometimes be necessary for the patient to make almost a complete change in his habits, mode of life, and possibly his business. Those who are habitual users of tobacco, alcoholics, or even strong spices should discontinue these, at least in great part. Where the disease is dependent upon irregular habits of eating and exercise, these must be corrected before much good can be accomplished by local treatment. Those who are continually exposed to irritating dust or vitiated atmosphere will sometimes be obliged to seek other employment. In such cases it has generally proved beneficial to have the patient apply to the pharynx two or three times daily some mild astringent. Tannic acid answers the purpose well in some cases, but usually the mineral astringents have seemed to me preferable. At intervals of from three to five days stronger applications should be made, such as the zinc, copper, or iron salts already recommended, and in particularly obstinate cases silver nitrate in strong solution should be tried. I have sometimes obtained great benefit in such cases from burning with the galvano-cautery narrow lines transversely across the pharynx from one-eighth to one-fourth of an inch apart. I usually make these lines about half an inch in length, not more than two or three being made at any one sitting.

Should these methods of treatment prove insufficient, it is well to advise a change of climate; if the patient lives upon the sea-shore or upon the borders of a large body of water he should move inland, his particular destination being apparently of little importance. If the patient is living inland he will sometimes be benefited by removing to other localities, either warmer or colder, or possibly even by removal to the vicinity of a large body of water, which might prove injurious to many other patients. Such cases are generally aggravated by a high altitude, where the air is dry and apt to be loaded with dust, and as a rule they are most benefited by warm equable climates.

The form of pharyngitis in which collections of dry or decaying secretions are found in the follicles has been considered much the most difficult to cure; indeed, the ordinary local applications to the surface of the pharynx appear to have little or no effect upon its progress. On the other hand, very satisfactory results may sometimes be obtained by passing into each diseased follicle a pointed stick of silver nitrate and thoroughly cauterizing the entire surface.

The most efficient treatment, however, consists in cauterizing the separate follicles with the galvano-cautery, not more than three or four being treated at any one sitting. By this treatment the exudative form of chronic follicular pharyngitis is often found to be more tractable than other varieties of the disease.

SYPHILITIC PHARYNGITIS.

Syphilis may be manifest in the pharynx in the primary, secondary, or tertiary stage of that disease. The initial lesion or chancre, which is of rare occurrence in the throat, when found is usually located upon one of the tonsils. In the secondary stage erythematous or mucous patches are characteristic, and in the tertiary period deep ulcers are observed. In inherited syphilis the secondary symptoms usually occur within four or five weeks after birth, and the tertiary symptoms may be found in infancy, though their development may be delayed until shortly after puberty. In secondary syphilitic pharyngitis usually the first manifestation in the throat is diffuse uniform hyperæmia, of which the color is not so bright as in ordinary acute catarrhal inflammations of the part. In a short time the congestion disappears from a large portion of the surface, leaving erythematous patches, the outlines of which are sharply defined. These patches are generally found on corresponding parts of both sides of the throat, and are commonly of much the same shape. They are more often observed upon the palate and pillars of the fauces, but are occasionally seen upon the posterior pharyngeal wall. Following these we find the development of mucous patches, known as mucous tubercles, or broad condylomata. These are usually found, when occurring in infants, in the upper part of the pharynx; in adults, upon the pillars of the fauces, the palate, the sides and base of the tongue, and the lips, especially at the angles of the mouth. These patches are commonly elevated about half a millimetre above the surrounding surface, and are circular or elliptical in form. Like the erythematous patches, they are frequently symmetrically arranged on both sides of the throat. At first of a deep red color, later they become covered with a whitish coating, similar to though less intense than that made by touching the mucous membrane with silver nitrate. The whole surface of the patch may be covered with this bluish-white pellicle, or superficial bleeding erosions may be observed where the pellicle is removed. The borders of these mucous patches are distinctly outlined, and are generally surrounded by a narrow areola of congestion, three to five millimetres in width. Exceptionally, in secondary syphilis, mucous patches are followed by rapid ulceration, the mucous membrane being destroyed to the depth of two or three millimetres. Such ulcers have a light pinkish or grayish surface, and sharply-defined but not indurated borders.

In the tertiary stage of the disease the ulcers are usually deep, with sharp-cut, indurated, and sometimes undermined edges. They are commonly preceded by gummata, which first appear as small, hard nodules beneath the mucous membrane, causing little or no inconvenience. These gummata gradually enlarge, and undergo degeneration and softening at their centres, the mucous membrane over them becoming deeply congested, and finally tense and thin, presenting a yellowish spot at the centre similar to that in small abscesses from other causes. Eventually this gives way, the

contents escape, and a deep ulcer with undermined edges remains. However, even in this stage two varieties of ulceration occur, the superficial and the deep or perforating. Superficial ulcers are most frequently found upon the palate, but are also seen upon the pillars of the fauces or tonsils, and occasionally upon the pharyngeal wall. They have irregular but sharply-defined borders, and are commonly only one or two millimetres in depth. Their bases are commonly covered with a foul, purulent secretion, which, when cleared away, leaves a pale, comparatively smooth floor here and there, studded with fungoid granulations. Fissures sometimes extend from the edges of these ulcers into the surrounding tissue. A gumma occurring in the palate is likely to cause destruction of the mucous membrane upon both sides with perforation. The deep ulcers of tertiary syphilis are more frequently situated in the pharynx near its central and upper portion, though they may be located upon either side, and may possibly involve only the naso-pharynx or laryngo-pharynx. They are commonly from three to five millimetres in depth, and have clear-cut indurated edges which are often undermined. Either variety of the tertiary ulcers is likely to spread rapidly for two or three weeks, causing great destruction of the parts. The activity of the ulceration commonly diminishes as it progresses, but unless properly treated the process may continue for several months or even years. When cicatrization takes place, adhesions between the edge of the palate and the pharyngeal wall often occur, with rapid contraction and closure of the greater portion of the opening between the mouth and the naso-pharynx. Complete closure is, however, seldom observed, though in many instances an opening remains not more than eight or ten millimetres in diameter.

Syphilitic pharyngitis is due to a specific virus, which may be either inherited or acquired.

Symptomatology.—The secondary manifestations are commonly attended with some dryness and soreness of the throat, and occasionally slight febrile reaction. In certain positions, where acted upon by the pharyngeal muscles, the ulcers are painful in deglutition, but in many cases they give rise to little or no inconvenience. They are usually attended by papillary eruptions upon the skin.

The tertiary form of the disease may develop insidiously, and not infrequently very considerable mischief has been accomplished before the patient is aware of the ulceration. The gummata usually cause but little inconvenience, and some of the ulcers are practically painless, yet in the majority of cases deep ulceration eventually causes painful deglutition, often so severe as greatly to interfere with nutrition. In such cases the constitutional symptoms are aggravated, and after a short time the patient may present very much the same appearance as one in the last stages of pulmonary tuberculosis. In most instances, however, the general health remains fairly good, even though the local disease may be very extensive.

Diagnosis.—The secondary, and sometimes the tertiary, manifestations of the disease are liable to be mistaken for *simple catarrhal sore throat*, but

usually after a few days the characteristic appearances are developed ; sometimes, however, nothing is observed but uniform congestion with slight thickening of the mucous membrane, which presents no diagnostic features. In such cases the differential diagnosis must be based upon the history and the results of treatment. Fortunately, these cases are comparatively rare, though it is possible that some cases supposed to be simple chronic pharyngitis are rendered much more persistent by latent syphilis. In the very inception of secondary syphilitic pharyngitis there may be general hyperæmia of the parts, but after three or four days fading away of the congestion over the greater part of the mucous membrane leaves well-defined symmetrical patches, or development of the slightly-elevated grayish mucous patch will render the diagnosis comparatively easy. The mucous patch may be mistaken for simple membranous or herpetic sore throat, but may usually be distinguished from the latter by the history and symptoms.

Herpetic sore throat comes on suddenly, without specific history. It gives rise to intense pain, and commonly to considerable constitutional disturbance. It runs a rapid course, and in most instances terminates in recovery within ten or twelve days. The herpetic patches are covered with thin membrane which has more of a yellowish tinge than that covering mucous patches, and they are not surrounded by the narrow zone of congestion so commonly observed in the latter, but are more apt to be located upon uniformly hyperæmic mucous membrane. Herpetic sore throat is usually extremely painful, in which respect it differs from most cases of secondary syphilitic pharyngitis.

Syphilitic pharyngitis may possibly be mistaken for acute *tubercular sore throat*, but commonly there is a history of much more gradual progress in the latter. In tubercular pharyngitis there are irregular poorly-defined superficial ulcers which are attended by extreme pain, instead of the comparatively painless and sharply-defined superficial ulcerations of syphilis.

The pharyngitis of tertiary syphilis is liable to be mistaken for *scrofulous sore throat*, or for tubercular ulceration of the pharynx. Scrofulous sore throat is a disease of childhood, syphilitic pharyngitis is commonly a disease of adult life. In the former the ulceration may be deep and extensive, but it spreads slowly, and is nearly always painless. In the latter the deep ulceration usually extends rapidly for two or three weeks, and is often attended by severe pain. The scrofulous ulcer commonly has a sharply-defined border, which, however, is not likely to be indurated and undermined like the border of the syphilitic ulcer. The antecedent history and the results of treatment will also aid in making the diagnosis. Tubercular ulceration of the throat is commonly superficial, though in exceptional cases deep, destructive ulceration occurs. In these latter the greatest care will be needed in making an accurate diagnosis. The history must be carefully inquired into, the condition of the larynx and the lungs ascertained, and sometimes we shall have to await the results of treatment before a definite diagnosis can be made. Usually, however, the constitutional symp-

toms of tuberculosis are well marked when this form of ulceration occurs in the pharynx. The tissues surrounding a tubercular ulcer are commonly anæmic and not indurated, while the tissues about a syphilitic ulcer are usually indurated eight or ten millimetres beyond its border, the overlying mucous membrane being of a deep pink or dull red color. If any number of tubercle-bacilli were found in the sputum this would settle the diagnosis, but in a large percentage of cases even of undoubted tuberculosis of the throat they are not to be found.

Malignant disease of the pharynx might be mistaken for syphilis, but may generally be easily distinguished from the latter by the more extensive induration of the parts, the slower progress of the ulceration, the frequent occurrence of sharp, lancinating, neuralgic pains independent of the movements of deglutition, a peculiarly offensive odor and sanious discharge from the ulcer, and finally by the difference in the history and the results of treatment. Under appropriate treatment the syphilitic ulcer may commonly be speedily healed, but the malignant disease grows gradually worse in spite of anti-syphilitic measures; indeed, it is very apt to be aggravated by them.

Prognosis.—Secondary syphilitic pharyngitis usually occurs within about three months after inoculation, and generally disappears under appropriate treatment within from six to eight weeks. Sometimes the symptoms subside even without treatment. In some instances renewed eruptions make their appearance every two or three months for a year or more. The gummata of the tertiary stage sometimes disappear without ulceration, but commonly softening and destructive ulceration occur, usually continuing for several months unless appropriate treatment be adopted. The ulcers generally spread rapidly for two or three weeks, and then, if left to themselves, gradually progress for a long time. In occasional instances the secondary lesions assume a phagedænic character, attended by fever, prostration, great destruction of tissue, and actual danger to life; these cases are, however, extremely rare. In the tertiary form of the disease ulceration is liable to cause destruction of the uvula and a large part of the soft palate, with extensive destruction of the pharyngeal wall. This, in case of healing, gives rise to adhesions, and contraction of the cicatricial tissue, with narrowing of the passages, which may seriously interfere with respiration, phonation, and deglutition. Not infrequently perforation of the hard palate occurs. In a few instances erosion of a large blood-vessel has caused speedy death from hemorrhage. In any case, unless appropriate treatment be promptly adopted and vigorously pursued, serious consequences are liable to occur. Partial or complete closure of the opening to the naso-pharynx from cicatricial contraction interferes with respiration and phonation; adhesions of the base of the tongue to the pharyngeal wall may interfere also with respiration and deglutition. Destruction of the palate imparts to the voice a characteristic nasal quality, renders articulation difficult, and causes much inconvenience in swallowing by reason of the regurgitation of food into the nasal cavities. Extension of the disease to

the larynx interferes with phonation and respiration, and not infrequently is the immediate cause of death.

Treatment.—When the inflammation occurs during the secondary stage of syphilis, small doses of mercuric bichloride or potassium iodide, alone or combined, may be effectively administered after each meal if the patient's general condition is good; otherwise ferruginous and bitter tonics are more beneficial. Indeed, many physicians are in favor of giving no constitutional treatment at all during this stage of the disease, but depend entirely upon local measures, believing that the ultimate results are better than when anti-specific remedies are given. Local applications of zinc chloride, ten to twenty grains to the ounce, are in my experience best adapted to the cure of the erythematous eruption. This may be best applied by means of the atomizer, and it is desirable to have it used by the patient two or three times daily, the physician making stronger applications every second or third day. For the mucous patches, thorough applications of tincture of iodine, silver nitrate, or tincture of the chloride of iron are often curative, and the solution of zinc chloride, as recommended for the erythematous patches, is a very satisfactory application. Solutions of copper sulphate containing from ten to twenty grains to the ounce may be employed in the same manner. In using the tincture of iodine the parts should be repeatedly touched at each application until the patch becomes of a dark brown color, and it is best to repeat the applications daily for a week or ten days. The silver nitrate may be used either in very strong solutions or as the solid stick; the latter should, however, be used carefully, lest too deep an eschar be formed. Whatever remedy is employed by the physician, it is desirable that the patient should use milder applications several times daily during the intervals. In the tertiary form of the disease, where large ulcers are present, I have found no remedy more satisfactory than full-strength tincture of iodine applied carefully to the ulcer in the manner just recommended. In case this fails, as sometimes happens, I resort to the copper sulphate in solutions of from ten to twenty grains to the ounce, and at the same time have the patient use at home a spray of zinc chloride, in strength as already recommended. It is especially important in this stage that anti-syphilitic remedies be administered freely, and that the treatment be continued until every vestige of the disease has disappeared. When the affection is of hereditary origin, and in peculiarly obstinate cases of the acquired disease, mercurials are specially beneficial, and in some other cases, where the iodides fail to accomplish the desired results, the bichloride of gold and sodium will cause speedy improvement.

Usually iodine in some form is most reliable in these cases. Of this class of remedies potassium iodide has appeared to be the most potent; though in some cases, especially where the stomach is easily disturbed, sodium iodide will be borne better, and its administration may be followed by equally happy results. Of these remedies, it is important that the doses be sufficiently large to produce a profound effect upon the patient.

It is my custom to begin with doses of five or ten grains, dissolved in water, and given largely diluted after each meal. After two or three days the dose is increased by five grains, and unless improvement in the condition of the ulcer speedily appears it is subsequently increased five grains each day until in some cases as much as one hundred and twenty grains have been given at a dose three or four times daily; this amount, however, is unusual, and it is seldom necessary to exceed twenty or thirty grains three times daily to accomplish the desired result. In any case, if healing begins and progresses during the administration of the smaller doses, it is unnecessary to increase the quantity of the medicine, and in all instances during the administration of large doses the patient should drink largely of pure water, in order that the remedy may be rapidly eliminated. In cases where extensive ulceration has involved not only the pharyngeal wall, but also the posterior edge of the palate, as cicatrization occurs there will be a strong tendency to closure of the opening from the mouth to the nasopharynx. This can be obviated only by systematic dilatation. Special care should be taken that the dilatation be faithfully performed just as the last portion of the ulcer is cicatrizing, for at this time contraction takes place with wonderful rapidity. I have several times observed patients in whom the healing was going on rapidly where a large dilator, the width of two fingers, could be easily passed from the mouth to the nasopharynx until about the end of the second week, when within twenty-four hours the opening has contracted so that a dilator half the size could not be passed without the greatest difficulty. At this time, therefore, the patient should be kept under daily observation, and the physician himself should dilate the opening, first having anæsthetized the parts with a solution of cocaine. The patient should then be taught to use the dilator himself, and instructed to introduce it daily for several weeks, or possibly months, after healing is complete.

Syphilitic pharyngitis in infants commonly occurs within the first year of life, though its development may be delayed until near the age of puberty. In children mucous patches are seldom seen, this stage of the disease probably having been passed during intra-uterine life, but deep ulceration of the fauces or pharyngeal wall is not very uncommon. The disease is usually associated with a similar affection of the tongue and nasal mucous membrane and disease of the nasal bones and cartilages, these latter being especially liable to syphilitic manifestations. The nasal inflammation gives rise to obstruction of the cavities and consequent difficulty in nursing, the result of embarrassed respiration. It is generally attended by a serous discharge that after a time becomes thick and purulent, sometimes sanguinolent, and so irritating that the nostrils and upper lip are excoriated. Specific fissures, pustules, and ulcers are commonly present in the nostrils and at the angles of the mouth. Ulceration in the pharynx may seriously interfere with deglutition. The profuse discharge from the nose, and the difficulty in nasal respiration, together with the pustules, ulcers, and fissures just referred to, and the peculiar ulceration in the pharynx, are the essential

points in the diagnosis. When the disease occurs in the first year of life it is nearly always fatal; older children may recover completely, but are apt to be left with great disfigurement of the nose and more or less destruction of the palate and consequent interference with the voice and respiration. The disease, extending to the Eustachian tubes and middle ear, frequently causes deafness. The later the appearance of the disease, the better will be the chances of checking it, but even in such cases it is liable to break out anew every few years.

Treatment.—The treatment is essentially the same as that recommended for the disease in adults, though it should be remembered that children bear mercurials better than older patients. In young children the local treatment should be so mild as to cause but little pain, especially applications made to the nasal cavities, which are extremely sensitive.

TUBERCULAR PHARYNGITIS.

Acute tubercular sore throat is a comparatively rare affection, occurring in only about one per cent. of all cases of tuberculosis of the respiratory organs, and the limitation of the disease to the pharyngeal wall is observed in only very few of these cases; uncomplicated pharyngitis of tubercular origin must therefore be extremely rare.

Tubercular pharyngitis is usually acute; the chronic form so seldom occurs as hardly to merit description. The acute disease, like tubercular ulceration of the larynx, runs a rapid course, and is characterized by superficial ulceration attended by great pain and the constitutional symptoms of tuberculosis.

The disease is first manifested in the mucous membrane by the appearance of small, gray, semi-transparent granulations grouped in patches beneath the epithelium. These, if abundant, closely resemble the mucous patches of syphilis. This resemblance, however, is not at all common. In any case these patches lack the inflammatory areola found about the syphilitic ulcer. Tubercular granulations are said to bleed easily when touched, but this statement, so far as it refers to the early granulations, is not borne out by my own experience, though when the disease has progressed somewhat farther, and the superficial ulceration has occurred, the parts bleed readily. The affection of the pharynx is nearly always associated with a similar affection of the palate, of the pillars of the fauces, or of the tonsils, and not infrequently at the same time or shortly afterward the same disease is found upon the epiglottis or the laryngeal mucous membrane. With the progress of the disease the granulations lose their transparency, become yellowish in color, and are soon hidden in a purulent or pultaceous covering, which, if removed, discloses superficial ulceration. These ulcers are shallow and have irregular, poorly-defined borders, running various distances into the surrounding tissue, the whole presenting a worm-eaten appearance. Usually, also, the mucous membrane about them is characterized by a grayish pallor, and by an absence of induration.

The affection is seldom if ever primary, but, whether so or not, is due to the same causes as general tuberculosis; we find, therefore, the symptoms of pulmonary or laryngeal phthisis, consisting of a peculiar expression of the countenance, anæmia, emaciation, fever, rapid pulse, dry, hacking cough, or cough with expectoration, and loss of appetite and other digestive disturbances. When the pharyngeal inflammation occurs independently of or with but slight pulmonary disease, the constitutional symptoms are not marked at first, though they generally become pronounced within a few weeks. The most prominent symptom of tubercular inflammation of the throat is the intense pain which is experienced upon deglutition, and sometimes even on phonation. This pain is sometimes so great that it prevents the taking of sufficient nourishment, consequently the strength rapidly fails, emaciation progresses, and the general disease rapidly advances. Pain is sometimes the first symptom, though it does not usually occur until after ulceration has taken place. In most cases an early examination of the fauces reveals unusual pallor or anæmia of the parts, and a few tubercular deposits, which cause the grayish granulations already referred to, together with moderate congestion of a limited portion of the mucous membrane, commonly confined to the edge of the anterior pillars of the fauces. The hyperæmia is seldom as pronounced as in simple catarrhal inflammation, and is not distinctly circumscribed or associated with swelling, as in syphilitic pharyngitis. When ulcers have developed they are seldom more than a millimetre in depth, they have poorly-defined and never undermined borders, and they are not surrounded by an areola of congestion like the ulcers of syphilis. The floor of a tubercular ulcer presents here and there grayish, indolent granulations, and is covered by a scanty, grayish, sometimes pultaceous secretion. In exceptional cases of chronic tuberculosis of the pharynx, more extensive ulcers, from one to three millimetres in depth, with well-defined borders, are found. In all cases in which I have observed these, the mucous membrane about them was but slightly, if at all, swollen, and was not congested, and the borders of the ulcer were neither indurated nor undermined.

Diagnosis.—The affection may be mistaken for syphilitic or scrofulous sore throat. The gray granulations or superficial ulcerations may be distinguished from the manifestation of *secondary syphilis* in the pharynx by the antecedent history and the excessive pain which accompanies the tubercular disease, together with the marked constitutional symptoms. In syphilis there is marked congestion, and symmetrical patches of hyperæmia or elevated mucous patches with superficial ulceration, each being surrounded by an areola of congestion; in the tubercular affection there are numerous small, gray, semi-transparent granulations, or, later, irregular superficial excavations without a surrounding areola of congestion, and usually with marked anæmia of the mucous membrane covering other portions of the fauces. The pain which accompanies the tubercular is much more intense than that of the syphilitic affection. In tubercular pharyngitis the parotid, submaxillary, and cervical glands are commonly enlarged, but this is not

the case in the sore throat of secondary syphilis. The deep ulcer which occurs in rare cases of tuberculosis of the pharynx may be distinguished from that of syphilis by the relatively slight congestion, induration, and thickening of the surrounding membrane, and by the intense pain with which it is accompanied, together with the constitutional symptoms and the pulmonary signs of tuberculosis. The ulcers of tertiary syphilis are deeply excavated, with sharply-cut, distinctly-marked, indurated, and frequently undermined edges, surrounded by an areola of a deep pink color; the secretion is profuse and purulent. These peculiarities are quite different from those already mentioned as characteristic of the tubercular ulcers.

Prognosis.—Tubercular pharyngitis usually runs its course within from six to twelve weeks, and terminates fatally, though in a few cases life has been much more prolonged, and in extremely rare instances complete recovery has occurred.

Treatment.—Whatever local treatment is adopted, constitutional remedies are of the utmost importance. Local applications have generally been futile, so far as healing of the ulceration is concerned, though the treatment recommended by Krause and Heryng has proved curative in some cases, especially of circumscribed deep tubercular ulcers. In extensive superficial ulceration it would often cause more harm than good. This treatment consists in thorough curetting of the ulcers, followed by the application of lactic acid in strong solution, with the occasional use in obstinate cases of the galvano-cautery. A few cases of deep tubercular ulcers of the throat I have seen recover without previous curetting, under the influence of lactic acid alone, applied in solutions varying in strength from twenty to seventy-five per cent. The application is followed by intense pain, which continues for several hours and therefore cannot be greatly relieved by cocaine. However, in favorable cases the pain caused by the applications grows less from day to day, and after six or eight applications the decided improvement in the appearance of the ulcer enables the physician to employ weaker solutions, which give the patient much less discomfort. The various other caustics, such as silver nitrate, chromic acid, iodine, and acid nitrate of mercury, have been worse than useless so far as I have observed their effects; however, the galvano-cautery, used sparingly and with caution, has sometimes proved beneficial. When the tubercular process is well marked in the larynx or lungs, it is doubtful whether any measures applied to the pharynx would secure cicatrization of the ulcers; therefore in nearly all cases our treatment must consist of sedative applications only. Chief among the remedies recommended for this purpose are inhalations of steam impregnated with belladonna, hyoseyamus, stramonium, or opium; sprays of the ten-per-cent. solution of cocaine; or the insufflation of powders containing morphine, bismuth, and iodol or iodoform. The applications of steam may be made by any suitable inhaler, and the medicated solution should contain in each ounce from half a grain to two grains of extract of belladonna, hyoseyamus, stramonium, or opium. Potassium bromide, twenty grains to

the ounce, has also been found beneficial in some cases. Cocaine solution may be applied by means of the hand atomizer four or five times daily, but the relief it gives is of short duration, and if used continuously its evil effects are much more pronounced than its beneficial results. In many instances I have given great relief by spraying the throat once or twice daily with a solution containing four grains of morphine and thirty grains each of carbolic acid and tannic acid, to four drachms each of glycerin and water. This solution in full strength often causes intense smarting for a few seconds, which is generally followed by relief from pain for several hours; weaker solutions of the same remedies cause less smarting, but give less permanent relief. Where patients are to make the applications themselves, a solution of half this strength should be preferred. Considerable relief from pain is often derived from the employment of troches of morphine, lactucarium, althæa, or slippery-elm bark. The insufflation of a powder containing five per cent. of morphine, twenty-five per cent. of iodol, and fifty per cent. of bismuth, with sufficient sugar of milk to make the hundred parts, will give considerable relief in some cases, and it may be readily practised by the patient himself. The addition of cocaine to this powder would seem indicated, but it seldom acts favorably.

These cases usually steadily progress, and often with great rapidity, especially when the pain prevents the taking of sufficient nourishment; therefore the greatest attention should be given to the patient's nutrition, and when it becomes impossible for him to swallow fluids they may be administered through the œsophageal tube or in the form of nutritive enemata.

RETRO-PHARYNGEAL ABSCESS.

This is a collection of pus in the connective tissue between the pharynx and vertebral column, chiefly characterized by interference with respiration and deglutition. It occurs most frequently in infants, particularly those who are poorly nourished or the offspring of scrofulous or syphilitic parents. It has been observed in new-born babes, but does not commonly occur until the child is several months old. The affection is seldom met with in advanced life, except in syphilitic subjects, in whom it is not infrequently the result of tertiary disease of the cervical vertebræ.

The abscess may be located at any part of the pharynx, from the vault to the level of the larynx, though it is most frequent in the upper half. About three-fourths of the cases are confined to one side. The primary location of these abscesses is not infrequently in one of the lymphatic glands of the anterior cervical region. The loose attachment of the pharyngeal mucous membrane favors the collection of pus, and allows it easily to burrow in a lateral or downward direction, sometimes even into the mediastinum. In one case which came under my observation after the abscess had opened, a sinus was found passing downward ten inches below the level of the tongue. The swelling formed by a retro-pharyngeal abscess

is broad at its base, and has a smooth surface like that of similar collections in other parts of the body, but it is not usually much congested, especially when occurring in feeble children. After a time the mucous membrane may become livid, and finally yellowish, as the abscess is about to point. When this disease occurs in syphilitic adults the membrane covering the collection of pus is usually considerably congested, but may vary in color from a deep pink to a bright red.

Etiology.—In children the affection is usually idiopathic, but apparently dependent in most instances upon a scrofulous or syphilitic diathesis. It may result from simple catarrhal pharyngitis, or may follow scarlatina, erysipelas, or inflammation of the tonsils. The exciting cause is usually exposure to cold or the debility attending prolonged heated periods in summer. Sometimes the affection follows injuries occasioned during the swallowing of hard substances. In adults the affection is nearly always the result of syphilitic disease of the vertebræ.

Symptomatology.—Retro-pharyngeal abscess is usually developed slowly, and is often of considerable size before it is detected. Usually stiffness of the neck is the first symptom to attract attention, but, if the patient is old enough, pain referred to the palate when the abscess is in the naso-pharynx, or a deep-seated soreness over the entire throat, is complained of. Difficulty in swallowing usually occurs within a few days, and respiration may be seriously interfered with, especially when the abscess is low down in the pharynx; indeed, dangerous dyspnœa, attended by cyanosis and other signs of suffocation, not infrequently occurs, and in children convulsive symptoms, commonly the result of obstructed respiration, are occasionally met with. In the beginning of the affection the patient usually experiences slight chilly sensations, or occasionally well-marked rigors. There is usually headache, and the head is commonly thrown backward or to one side in an effort to relax the muscles and relieve the tension of the inflamed parts. Painful tumefaction of the side and front of the neck is frequently observed. There is quickening of the pulse and a slight rise in temperature. If the abscess is located above the palate it interferes only with nasal respiration; in the oro-pharynx it does not usually interfere with respiration unless it becomes very large, but when occurring in that portion of the pharynx just above or behind the arytenoid cartilages the crowding of the mucous membrane forward obstructs the larynx and speedily causes severe dyspnœa, subject to distressing and dangerous exacerbations and attended by cough and stertorous respiration. The voice acquires a nasal twang when the abscess is located high up, and becomes hoarse or is entirely lost if the tumor presses upon the larynx. Large abscesses at any part of the pharynx, or smaller ones located near the opening of the œsophagus, seriously interfere with deglutition, which is often attended by severe spasms of the glottis, due to the running of fluids into the larynx. Upon inspection of the parts, a medium-sized abscess of the naso-pharynx may be easily overlooked, but usually its lower part may be seen, and in any case where

stiffness of the neck, the peculiar position of the head, and obstructed nasal respiration have gradually developed, the physician should always inspect the pharyngeal wall as high as possible.

The swelling caused by this disease, when fully developed, is commonly of a dusky-red color, having a semi-elastic, doughy feeling, which later becomes distinct fluctuation.

Diagnosis.—The disease is liable to be mistaken for croup, œdema of the glottis, foreign bodies in the larynx, and for cerebral or digestive disorders, which might cause convulsions. Locally it is possible to confuse the appearance of a retro-pharyngeal abscess with that of hæmatoma, lipoma, or other soft tumor or swelling.

From *œdema of the larynx* it may be distinguished by inspection and palpation, and by the history of the case. Œdema of the larynx causes dyspnœa similar to that produced by abscess of the laryngo-pharynx, but it is stated that the two may commonly be distinguished from each other by lifting the larynx, which relieves the dyspnœa in the case of abscess, by raising the organ above the seat of obstruction, but does not give relief in œdema.

Croup causes dyspnœa and stertorous respiration similar to that observed in some cases of the disease under consideration, but the voice is much more apt to be lost than in retro-pharyngeal abscess, and there is no swelling or dysphagia.

The history of the case is usually sufficient to distinguish this disease from *foreign bodies in the larynx or pharynx*, and, when not, the diagnosis may commonly be cleared up easily by inspection and palpation, though rarely a foreign body becomes impacted in the pharynx and causes swelling closely resembling the disease under consideration, or may eventuate in abscess. Foreign bodies in the larynx excite spasmodic contraction and interfere with respiration much more than the pharyngeal abscess, but in adults, and very often, also, in comparatively young children, a laryngoscopic examination will readily clear up the diagnosis.

The various *affections of the digestive organs and of the brain*, causing convulsions, can be distinguished from those cases of retro-pharyngeal abscess in which these symptoms occur, only by attention to the history and a careful examination of the parts.

A *hæmatoma* or *lipoma* must be differentiated by careful inspection and palpation, and reference to the history; the exploring needle may give conclusive evidence as to the nature of the swelling.

Prognosis.—Although the disease usually comes on insidiously, it may reach its height, in idiopathic cases, within forty-eight hours, but commonly not before from five to ten days. In most idiopathic cases recovery is said to occur within five days, but when the disease is secondary to other affections the pus may not be discharged for a week or ten days. Fatal results are not uncommon, though the majority of these patients recover. Cases due to spondylitis are of much longer duration, as a rule, and seldom

terminate in less than three weeks, while they not infrequently last for several months, usually proving fatal in the end. In favorable cases the abscess opens spontaneously, unless sooner relieved by the surgeon. In either instance, when the pus escapes, convalescence is commonly rapid. In neglected cases the pus may burrow low down in the pharynx into the mediastinum or areolar tissue of the neck or the ary-epiglottic folds, when it may cause suffocation by mechanical obstruction to respiration. In some cases death has speedily followed the escape of pus into the respiratory passages. An abscess extending to the mediastinum may open into the œsophagus or the pleural cavity, either of which would be dangerous,—owing in the former case to the escape of food into the areolar tissue, or to the production of subcutaneous emphysema from the escape of air during the act of deglutition; in the latter, owing to acute purulent pleuritis following the accident. Death has also resulted in cases of this kind from ulceration into the carotid artery.

Treatment.—If seen in the very beginning, an attempt should be made to abort inflammation by the almost constant administration of cracked ice and by cold applications to the neck. But usually the patient is seen too late for this method to prove efficient, and in most cases the age of the patient will preclude its satisfactory operation. Nothing then remains but to evacuate the pus as soon as it is discovered. The patient will subsequently need ferruginous and bitter tonics and alteratives, with good, nutritious diet and plenty of out-door air. The remote or exciting cause should always be sought for as an indication of the remedies to be administered. In opening the abscess the patient may be placed in the prone recumbent position, or the head must be inclined far forward at the time of the incision, or immediately after it, to prevent the passage of pus into the larynx. The puncture or incision, whether made with a laryngeal lancet or with an ordinary bistoury wrapped with adhesive plaster to near its point, should be made as near as possible in the posterior mesial line of the pharynx, to avoid wounding the internal carotid artery.

ACUTE LARYNGITIS.

BY JACOB D. ARNOLD, A.M., M.D.,

President and Professor of Laryngology, San Francisco Polyclinic and School for Post-Graduate Instruction; Consulting Surgeon, Children's Hospital, etc., San Francisco, California.

SIMPLE ACUTE LARYNGITIS (catarrhal laryngitis; acute catarrh of the larynx; simple laryngitis; laryngitis catarrhalis acuta), in which only the mucous membrane is involved, is an affection of so common occurrence and so little gravity that medical aid is seldom resorted to for its relief, except in the case of professional voice-users. On the other hand, when the inflammatory process involves the submucosa, as happens in the severer and more particularly in the phlegmonous form,—a form that may be a primary affection or a secondary manifestation of systemic disease,—it is a disorder of the gravest import, threatening the life of the patient by asphyxiation from rapid œdema of the larynx.

ETIOLOGY.

Almost without exception, writers upon throat-diseases assert that the most common cause of acute laryngitis is "taking cold;" and with equal unanimity, feeling that the statement needs some modification, they add, the exposure itself does not produce the affection unless the individual be in some manner predisposed to catarrhal disease. There can certainly be no doubt that catarrhal inflammation of the lining membrane of the larynx is one of the most common expressions of what is called "catching cold," and, as far as the air-passages are concerned, is, in point of frequency, second to coryza only. It is perfectly well understood that the ordinary inflammation of mucous membranes that so often follows exposure to cold is not directly caused by the abstraction of heat from this tissue. This inflammation is the resultant of a complex series of disturbances of circulation-equilibrium initiated by exposure of the body or some part of the body to a relatively low temperature, and brought about through the mechanism of the vaso-motor system.

The present status of the whole question of "taking cold" is of particular interest to those who are engaged with the treatment of diseases of the respiratory organs, because of its prominence as a factor in the causation of disease in these organs. But the interest by no means ends here. It is,

perhaps, no exaggeration to say that among the elements of general etiology of disease "taking cold" easily ranks first in respect of importance and universality.

The unwholesome influence of cold has ever been a phenomenon of such frequent recurrence that it could not escape the observation of the least curious; and the disorder of health usually follows so closely upon the exposure that the causal relationship between them must have become patent even to the least logical of observers. It is, therefore, not surprising that at a time long prior to the birth of the "art of healing" students who embraced the record and description of disease in their philosophical speculations ascribed to climatic conditions a rôle in the causation of disease second in importance only to the anger of an offended deity. Even the influence upon human well-being exercised by the conjunctions and perturbations of the heavenly bodies appeared comprehensible and more worthy of credence after it became possible to trace that influence through the mediation of tide, wind, and rain. That the erratic wanderings of a comet, a storm upon the surface of the sun, or the awful obscuration of his light should be attended by some profound disturbance of our atmosphere seemed a physical necessity, and that such disturbance, so far as it might alter the temperature and density of our air, should affect the health and lives of earthly creatures was a reasonable and warranted conjecture.

The student of the history of medicine will find therein many instances of quasi-evolution, in which an hypothesis of fair scientific accuracy has gradually grown about a fanciful theory for observed facts; the terms of the proposition remaining almost identical in form long after their meaning has undergone radical change. Etiology has been a natural field for such growths. "Taking cold" has long been recognized as an important factor in the causation of various diseases; or, to put it more exactly, "a cold" was recognized as an inciting occasion for the development of various diseases long before any attempt was made to supply a true rationale of the process. It is, of course, very clear that an available rationale for any morbid process, whether evidenced by alteration of structure or function, or by alteration of both, must be conditioned and limited by our present understanding of the chemistry and physiology of the tissues involved. This may appear very like a truism; and yet how long has it been since we gained our very incomplete knowledge of the intimate interdependence of tissue-composition and tissue-activity?

Particularly involved is the series of incidents and conditions that go to make up the "altered physiological activities" lighted up by "taking cold." Recognized as the most frequent and principal factor in the production of that large class of pathological processes, catarrhal (Virchow and Cohnheim, exudative) inflammation, it is withal imperfectly understood. Some of the obscurities of the subject may, perhaps, be formulated by the following instance. Six robust individuals, apparently in perfect health, who have been engaged at some indifferent occupation in a heated room, hear an alarm in

the street; the six people go to a window looking into the street, open the window, remain exposed to a draught of cold air for the space of from thirty to sixty seconds; the window is then closed and they resume their former occupations. Immediately—perhaps even before the window has been closed—one of the company begins to sneeze violently, and finds himself in the initial stage of a coryza; nostrils hot, dry, and partially occluded; a sense of heat in the eyeballs; eyelids puffed and itching; a disagreeable sensation of “inward heat and outward cold.”

A second individual of the group experiences, a few moments after the exposure, a severe attack of facial neuralgia, which, with short intermissions, lasts weeks or months.

A third is seized with a feeling of discomfort in the ear, and after a few hours finds an old otorrhœa, that had apparently been healed for years, again become active.

A fourth can fairly ascribe to that moment of exposure the beginning of an attack of acute bronchitis, or pneumonia, or cystitis, or rheumatism, etc.

The above instance is imaginary, but it does not in any essential particular lack verisimilitude. Every practitioner of medicine will be able to group under each of the above cases a large number of instances from actual experience.

To return to our example: here are six individuals, all apparently in perfect health, subjected to the same draught of cold air, for the same length of time, and each becomes afflicted with a distinct morbid process. Not the least remarkable feature of the case is the fact that a momentary exposure of the same part of the body to an influence that has *a priori* so little power of harm should produce such profound and wide-lying effects.

There was a time when the very phrase “taking cold” was religiously avoided by medical men, as savoring too much of popular etiology; but we have no better expression at hand, and it is doubtful if one could be invented that would so well “stand for” what it is intended to convey. The masterly work of Hermann and Vulpian has given us a better understanding of the vaso-motor mechanism, and made more clear the prodigious importance of “taking cold” for pathology. It may be truly said that if the whole series of vital phenomena—chemical and mechanical—which are so glibly summarized by the expression “a cold” were fully known, it would supply the key to all pathological processes and a safe guide to that Canaan of modern medicine, a rational prophylaxis. Many steps have been taken in this direction; many theories advanced. They all recognize, as the connecting link between the tangible cause and the observed effects, a disturbance of systemic blood-circulation produced by local abstraction of heat. All explain that the site of the morbid effect will be the *pars minoris resistantiæ*. Rosenthal, Martinache, Seitz, Woakes, are each impressed with the great importance of the subject, and differ very little among themselves in their accounts of the scheme of “taking cold;” unfor-

tunately, too much of the scheme is only ingenious conjecture. Bosworth,¹ in his excellent chapter on this subject, in which good account is taken of the vanishing border-line between physiological and pathological nutrition activity, gives, we think, undue weight to the "previous condition of the tissue" in determining the site of the effect. This is ascribing a positive value to what is for the most part an unknown quantity; a practice useful in mathematics, but vicious in medicine.

It appears to us that no writer upon this subject with whose work we are acquainted, except perhaps Woakes, has laid sufficient stress upon the fact that, physiologically considered, the circulation apparatus of the alimentary canal is *peripheric*, and a counterpoise to that of the skin. The facts that one rarely takes cold during active digestion, that a hearty meal will often cut one short, that a quick cathartic is as often effectual in aborting a cold as is a dose of pilocarpine or a hot pack, are perfectly well known, but the conclusion to which they point has never been properly utilized in the "vaso-motor theory." We believe that if the hypothesis which Woakes has so materially advanced were rounded off by a sufficient account of the ebb and flow of certain vital functions (principally the difference in the supply of nerve-force and blood to the digestive tract while active and while at rest) it would supply a valid explanation of the protean modifications of nutrition which perhaps is the "key universal" to pathology.

Perhaps much of the above will appear a digression; yet, we fancy, the importance of the matter in general, and particularly for diseases of the respiratory organs, is ample justification.

Wet feet, damp clothing, the inhalation of cold air, especially if it be breathed through the mouth for a considerable length of time, are all common causes of laryngeal catarrh; and, on the other hand, we have been informed by a physician who is the proprietor of a "Turkish bath" that he knew of two cases in which a brief sojourn in a "steam-closet" (temperature 130° to 140° F.) produced intense laryngitis accompanied by œdema; both sufferers were habitual drinkers.

Habitual mouth-breathing, from whatever cause,—hypertrophic rhinitis, deformed septum, adenoid vegetations, enlarged tonsils, etc.,—is conducive to attacks of acute laryngitis, because of the direct irritation from unwarmed, unfiltered air.

The inhalation of irritant gases, fumes, dust, and even tobacco-smoke may produce intense laryngitis. Prolonged use of the voice in speaking, singing, shouting, especially in the open air, is a more common cause.

Under traumatic causes must be counted the too free or too vigorous use of caustics and surgical instruments; for the most part, however, inflammation so produced is limited in extent and transient in character.

During the course of acute arthritis, and of all eruptive febrile diseases, the laryngeal mucous membrane, as well as that of the nares, pharynx,

¹ A Treatise on Diseases of the Nose and Throat, vol. i. p. 57.

and trachea, may be the seat of an acute catarrh, which sometimes assumes a phlegmonous or an œdematous character, and becomes a very serious complication (scarlet fever, erysipelas, and typhoid fever). Very frequently laryngitis appears as an incident in the course of an acute catarrh that commences in the nares and makes an excursion down the air-tract; in such cases the rhinitis, pharyngitis, laryngitis, tracheitis, and bronchitis are mostly of a very mild character. Sometimes the nares and pharynx will have returned to a normal condition before the catarrh has reached the bronchi; and again, the mucous lining of the entire air-passages, smaller bronchi and air-vesicles alone excepted, is the broad theatre of acute inflammation. At times the disease will skip the pharynx and appear in the larynx; or the latter is included in the jump and escapes altogether, or is implicated by a sort of rebound from below. Occasionally it makes its first appearance in the trachea and slowly progresses upward to the nares. It would appear that these seeming "vagaries of disease" are in reality types; for inquiry often elicits the fact that the form of this "catarrhal progression" is pretty constant with the individual. No doubt the most common form is simple extension by contiguity, and any habitual departure from that type has some underlying anatomical reason.

The frequently-recurring attacks of acute laryngitis in consumptives, long before the throat becomes the seat of tuberculous infiltration, are well known. Later in this disease, as well as in syphilis, lupus, and carcinoma, a specific laryngitis occurs that is of course acute for a while, but the breaking down of tissue soon supervenes, and the true nature of the disease becomes manifest. It remains to be mentioned that some individuals are, without discoverable reason, plagued with particularly sensitive throats, which react out of all proportion to the intensity of the exciting cause; it is perhaps more logical than useful to apply here the term "predisposition."

In the majority of all cases of primary acute laryngitis the interference with general health is so slight, the symptoms so trivial, and the course so short, that medical help is not sought,—at least, not from the hands of the physician. Yet, as the earliest and most constant symptom is hoarseness, even a mild case becomes of moment to all those whose vocations demand frequent use of the voice. Herein lies the reason for a mistaken conclusion that is common to nearly all writers upon this disease. The matter is usually stated in some such form as this: "singers, actors, public speakers, etc., are particularly prone to laryngitis, because the frequent and prolonged use of the voice necessitated by their occupations produces a physiological (*sic*) hyperæmia of the vocal organ, and such hyperæmia renders it exquisitely sensitive to atmospheric influences," etc. Now, all this sounds plausible, but the premises are only partly true, the reasoning sadly awry, and the conclusion absolutely false. Singers, actors, and public speakers are much discommoded in their pursuits by the slightest impairment of voice, and, naturally, are driven to the physician by every ailment that affects it. To followers of other vocations a little hoarseness is a matter

of no moment. The larynx is certainly no exception to the physiological law that increased functional activity in an organ determines to it increased blood-supply; but it is equally certain that no physiological law demands that the organ be thereby rendered weak and more prone to disease. Quite the opposite is true; the organ is thereby rendered stronger, more capable of extraordinary activity, and more resistant to disease. And this is particularly true of the larynx. A well-trained and practised singer will, without hurt to his throat, sing for hours in a large hall or in the open air; whereas the unpractised amateur loses his voice and contracts a laryngitis with half the effort. We have observed a professional auctioneer, after four hours' almost continuous howling at a thousand hearers in the open street, leave his stand with voice as clear and unruffled as when he began. We have seen an amateur at a church fair grow raven hoarse and cough blood after fifteen minutes of mild effort to sell a French doll. Of course, in such instances, account must be taken of muscular fatigue from ignorance of method; but muscular fatigue is always the first symptom of a laryngitis fairly ascribable to abuse of the voice. We venture to assert, therefore, that, although a large majority of all subjects of acute laryngitis who apply to the physician are professional voice-users, or people who sing, this affection is far less frequent in this very class than in any other. Independent of such considerations, there can be no objection to the statement that all influences which are capable of producing considerable hyperæmia (increased nutritive blood-supply is not morbid hyperæmia) of mucous membranes are possible causes of catarrh. Equally indisputable and enlightening is the other stereotyped clause: "constitutional defect in assimilation, low vitality, poor food, and ill-ventilated rooms are all conducive to laryngeal inflammation;" they be conducive to a great many unpleasant things, my masters.

PATHOLOGY.

In the larynx, the phenomena common to catarrhal inflammation in general are modified only in so far as diverse thickness of the mucous membrane and closeness of attachment to the underlying structures are peculiar to this organ. Varying degree and extent of hyperæmia and swelling are attended first by diminished, but soon after by increased, secretion. This secretion, in the beginning thin and translucent, contains few epithelium cells (Rokitansky); as it increases in quantity it grows thicker, more opaque, richer in mucin and desquamated epithelium, and is occasionally streaked with blood; finally, again, less profuse, thick, adherent, containing pus and lymphoid cells (Klebs, Eppinger). Slight erosions are found in nearly all cases. Aphthæ (lenticular ulcers, follicular ulcers) are less common; true ulcerations, extending into the submucosa, are very seldom met with in primary cases. Phlegmonous infiltration and œdema belong to the exceptional manifestations of this disease. Simple catarrhal laryngitis is so very rarely fatal that descriptions of typical tissue pathology are

not forthcoming. In several instances, where the subject has died of intercurrent disease, slight succulence of the mucous membrane, with loss of epithelium, exposing in spots the deeper layers, was found (Eppinger, J. N. Mackenzie). Simple catarrhal inflammation, as exhibited in the mucous membranes of the air-passages, may serve as the most typical example of those morbid processes that are for the most part only disturbances of nutrition (Birch-Hirschfeld).

The nature and importance of the functions of the larynx render particularly obtrusive the effects of disease in this organ. Considered anatomically, Burdon Sanderson has pointed out that "in disorders in this region it is particularly striking how vague and elusive is the border-land between normal nutrition activity and inflammatory disturbances of the circulation,—that is, between health and disease." Cohnheim's vascular theory of inflammation appears especially valid when applied to catarrhal diseases of the air-passages which present at once a clear picture of a pathological process and the main features of its clinical history.

The secondary laryngitis of the exanthematous and septic diseases does not in the early stages differ from the primary form, except in its greater likelihood to involve the submucous tissue and assume a phlegmonous character.

SYMPTOMS.

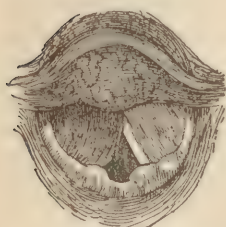
Objective Symptoms.—As has been indicated above, simple laryngitis is usually productive of so little discomfort that the patient is not "ill" enough to consult the doctor. He has some little uneasiness about the throat, a trivial cough with hoarseness, perhaps a slight rise of temperature, and headache; he is quite familiar with the trouble; has often been affected in the same manner, and knows he will mend in from two to seven or eight days without (or with) treatment. If an opportunity present to examine such a case with the mirror, there will be found a variously intensified coloration of the whole larynx, perhaps extending some distance into the trachea; a simple hyperæmia accompanied by almost no perceptible swelling. The vocal cords are faintly pink, with here and there a speck of dryish secretion upon their upper surface or clinging to their free edges. Though this is the ordinary picture, it is not unusual to meet cases in which the inflammation is "intense in spots" (Guttman), or seemingly confined to the cords or the epiglottis, or to one ventricular band. One variety of such cases is beautifully illustrated by Lennox Browne.¹ The drawing, which is in color, depicts a larynx in which the catarrh is strictly confined to the epiglottis and right ventricular band. In this excellent work, which, by the way, is illustrated by the pencil of its artist author in a manner above all criticism, Browne says, "As a rule, the inflammation is spread uniformly over the whole larynx, degrees of severity depending rather on differences of grade than of extent. But it sometimes happens that an

¹ Lennox Browne, *The Throat and its Diseases*, 2d ed., plate vi., fig. 49.

acute catarrh is strictly limited to quite special regions, whilst the rest of the larynx remains to all appearances entirely or comparatively normal. Thus, Türk, Ziemssen, and Störk all speak of an epiglottitis, an arytenoiditis, and a chondritis as special affections. These distinctions have also been adopted by Cohen. They are of no particular practical value." (Fig. 1.)

Until a comparatively recent experience, we had been inclined to accept Browne's opinion regarding the "idiopathic epiglottitis" of Störk.¹ The cases detailed below have convinced us of our error, and we now fully subscribe to Störk's statement "that under certain conditions there may develop an acute primary inflammation of the epiglottis, whilst the other parts of the larynx and pharynx remain unaffected."

FIG. 1.



Inflammation confined to epiglottis and right ventricular band. (Lennox Browne.)

On January 19, 1891, the writer was called to — Hall, a school for boys, in the suburbs of San Francisco. He found there six patients (a tutor and five pupils) ill with a grave form of sore throat. The principal of the school gave the following account. On January 17 a party of three tutors and eight of the boys had gone punting for ducks on the Alameda mud-flats. The night of the 17th was spent by the party in a large house-boat moored in one of the lagoons on the Alameda shore. Next morning, at daybreak, two of the boys complained of sore throats,—had some fever, and were too ill to go out with the guns. They were left in the care of the cook, a Chinaman, and the rest of the party went off in the punts. When they returned, at two o'clock of that afternoon, every member of the party complained of being ill; some from sore throats, some from intense headaches, and some from nausea and vomiting. They fancied that the bad air of the marshes might be the cause of all this disorder, and wisely resolved to leave at once. They remained in the town of Alameda over the night of the 18th, and were visited by a physician of that place, who diagnosed malaria and prescribed quinine and whiskey for them all. On the morning of the 19th they crossed the bay and returned to the Hall. On getting home, five of the boys and a tutor had very painful throats and considerably elevated temperature, and were sent to bed; the others appeared to have recovered, or at least made no complaint. The most alarming case, and the one which naturally claimed first attention, was that of a Cuban, seventeen years of age. He was found in bed, propped in a sitting posture; the respiration was loud, labored, and shallow; the face anxious and pinched; the skin cold and clammy. Direct inspection of the throat at once revealed the cause of the dyspnoea; there presented behind the tongue a large pinkish-white tumor which almost filled the lower pharynx, evidently an oedematous epiglottitis. (Fig. 2.) The tumor

¹ Klinik d. Krankheiten d. Kehlkopfs d. Nase und d. Rachens, 1880, p. 200.

was freely scarified, and an ice poultice applied to the neck. The scarification was very soon followed by a spasm of coughing (probably due to the trickling of blood and serum into the cavity of the larynx), which left the breathing more embarrassed than before. Further delay appeared dangerous, so the windpipe was opened below the thyroid isthmus, without anæsthesia. As no tube was at hand, the opening was made quite long, and the edges of the trachea were held apart by retractors improvised from knitting-needles, for nearly an hour, until a proper tracheotomy tube became available. Under the local application of ice and of pilocarpine muriate, grain one-third, hypodermatically (two injections only were made), the swelling of the epiglottis subsided rapidly. The tracheal tube was removed on the third day.

In the five other cases no alarming symptoms presented. In each there was intense inflammation of the epiglottis, with more or less swelling of its laryngeal face and crest; in no case was there any apparent involvement of the rest of the larynx; in no case but one (that of the tutor) was there anything abnormal in the pharynx. His throat, in addition to the epiglottitis, showed some redness and swelling of the soft palate, with œdema of the uvula, from the tip of which depended a little translucent sac the size of a very large pea; this was snipped off with scissors.

These cases exhibited no very grave symptoms; yet the experience with the Cuban induced me to arrange that a surgeon should be in constant attendance day and night until all were convalescent. Fortunately, no accident occurred, and the cases all yielded promptly to salicylic acid and the ice poultice.

On February 3 I paid my last visit to the school and discharged the last boy from the infirmary. The tutor described the course of his own case in the following words, and his description will serve very well for all those in whom the throat-trouble was most prominent:

"On the morning following the night spent in the house-boat I felt that I had taken cold; I sneezed violently, my throat felt dry and parched, and I had severe headache. After drinking some hot coffee, however, I felt well enough to go off with the boys. Before noon the sore, stiff feeling in my throat had increased again; I felt feverish, and, as every one in our party was making some complaint, I gave the signal early in the afternoon to return to the house-boat. Two hours later we left the flats for Alameda; there a physician reassured us with the phrase '*only malaria.*' I got no

FIG. 2.



œdema of epiglottis. "Acute miasmatic epiglottitis."

sleep that night, and by morning my throat had grown so painful that I could swallow nothing but a few drops of water. I had a harsh, dry cough; my tongue and the roof of my mouth felt sore and swollen. We reached the Hall at ten o'clock of that morning, by which time I began to mend. For two days I ate almost nothing, because of the extreme painfulness of swallowing."

It seems perfectly clear that these cases are to be described as a peculiar form of acute laryngitis, due to exposure to some animal, vegetable, or chemical poison present in the exhalations of salt marshes. At a meeting of the County Medical Society of San Francisco I gave an account of the above experience, and its discussion brought out the fact that quite a number of similar cases had come to the notice of some of the members; unfortunately, in only one case was the throat examined laryngoscopically. There was also elicited the information that in 1878 a duck-hunter was found dead in his boat on Suisun Bay, and that the coroner's inquest (at which the reporter of the case assisted) discovered that death had resulted from "œdema of the glottis." It may not be amiss to suggest the name "miasmatic epiglottitis" for such cases.

It has been noted above that the relative degree of hyperæmia observed in the different regions of the larynx is chiefly determined by anatomical conditions and optical effects. Upon the cords and the superior third of the epiglottis the mucous membrane is thin and closely adherent, and there is almost no trace of submucosa; consequently, in these districts injection and swelling are usually less than in the contiguous parts. But as the normal color of the cords is a brilliant white, and of the epiglottis a pinkish yellow, relatively slight degrees of inflammation will be the more striking because of the color-contrast. On the other hand, the ventricular bands and ary-epiglottic folds, which contain a thick layer of submucosa and an abundance of glandular tissue, because of the looseness of their texture are more subject to deep injection and considerable swelling in comparison to the "leaner" regions of the larynx. Further, it is to be remarked that these anatomical differences are also of importance in so far as they determine the prominence or subordination of the symptoms of disease, such as pain, altered respiration, phonation, secretion, etc.

The secretion, which is very scant at first, soon becomes quite thick with desquamated epithelium and mucin, and, later, pus. In this state it is particularly likely to collect in clumps at two spots upon the cords which may be termed the nodal points,—namely, at the vocal processes of the arytenoids, and at about four or five lines behind the anterior commissure, where the sesamoid cartilages of Meyer are found, when present. The persistence with which these grayish, rounded masses of secretion retain their position even after violent coughing, and spraying of the throat, deserves to be mentioned, since they may easily be mistaken for commencing ulceration, or warty growths. The so-called "*milchige trübung*" and "cloudy swelling" of patches of epithelium, before they are thrown off,

are occasionally seen. The resulting erosions are more commonly detected; in the severer cases they become the site of superficial ulceration.

Many writers (Schroetter, Lennox Browne, and Mandl among others) have been at great pains to show that catarrhal ulcers never occur in the larynx. The reasoning adopted by these authors makes it appear that it is a matter of conscience with them to deny the term ulcer to any "sore upon the mucous membrane that does not extend through its whole thickness." Perhaps, with the Germans especially, the term "ulcer" has acquired too much latitude; yet there can be no good reason to deny that designation to any circumscribed loss of substance due to non-traumatic necrosis, and undoubtedly this condition is presented in severe forms of laryngitis, even when there is no suspicion of constitutional disease.

Störk¹ has devoted a whole chapter in his classical work to a peculiar form of ulcer that he has found to be quite common in chronic laryngitis and sometimes present in the acute variety,—the "*fissura mucosa inter-arytenoidea*." According to him, it is a frequent complication of long-standing catarrh, and he ascribes it to causes analogous to those that obtain in *fissura in ano*. "The thickened, congested mucous membrane in the inter-arytenoid space cracks, as would a piece of starched linen, from constant folding and unfolding. The raw surfaces of the fissure thus produced become ulcerative from the combined action of friction and irritating secretion."

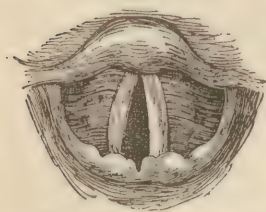
Schroetter bluntly discredits its occurrence. In the year 1879 we attended the clinics of these eminent men, and it was always amusing to compare their utterances upon this point. Schroetter would say contemptuously, "They talk about a '*fissura mucosa*' to be found in fifty per cent. of all cases of chronic catarrh. We see a *few* cases of catarrh here, and I ask you, gentlemen, have you ever beheld the *creature*?" Störk once or twice every week would suddenly stop while examining a new case, with a triumphant "Come here, come here, everybody. Now, gentlemen, you of course know that *certain individuals* persist in denying the existence of my '*fissura mucosa*;' sit here, examine this larynx, and then go and tell *them* what you have seen. Don't I demonstrate the *fissura* to you every day of my life?"

It should not be forgotten that the inter-arytenoid space is, so to speak, *the elbow of the larynx*, and that its investing membrane is disposed in a very loose manner over the deeper tissues in order to allow play for the continual bending and unbending at this point. The puckering is of course most pronounced during phonation. The normal rugæ thus produced are, moreover, covered with an unusually thick epithelium, which being comparatively opaque renders inflammatory coloration of this space less intense than that of contiguous regions. The epithelium itself is a colorless semi-translucent tissue containing no vessels; its apparent pink or red color is

¹ Op. cit., p. 209.

due to the shining through of the blood-vessels in the subjacent tissue. This cloudy, wrinkled appearance of the membrane between the arytenoids

FIG. 3.



"Rugæ" of inter-arytenoid space simulating ulceration in simple laryngeal catarrh.

is particularly noticeable in a hyperæmic larynx, and when, as is quite common, gray masses of secretion are retained in the furrows, the whole picture is so like that of ulceration that a mistake is possible even to an experienced eye. (Fig. 3.)

A number of cases of simple catarrh with *hemorrhage* into the tissues or upon the surface of the larynx have been reported (Türk, Schroetter, Meyer, Schmidt, Fränkel, Strübing, Lefferts, Hartmann, Morgan, Gleitsmann). Slight ecchymoses, for the most part upon the cords, are common enough; they are sometimes caused by violent cough and the rough use of instruments. Profuse hemorrhage from erosion of vessels during the course of laryngeal ulceration (tuberculosis, carcinoma, syphilis, variola, traumatism) is an unusual accident. Strübing's proposal of a distinct category—*laryngitis hæmorrhagica*—appears unnecessary.

Edema, fortunately, is a complication seldom encountered in simple laryngitis; indeed, it is fairly questionable if it ever occurs in this affection in individuals free from organic or constitutional disease, except as the result of traumatism. Many writers describe "œdematous laryngitis" (syn. phlegmonous laryngitis, purulent laryngitis, submucous laryngitis) as a disease *sui generis*; others describe it as a peculiar variety of simple laryngitis. Much confusion arises from this practice. Perhaps for no department of medicine is the practical importance of a rational nosology so pronounced as for diseases of the larynx, and just here the classification is hopelessly involved.

Only in the mildest cases of laryngeal catarrh does the submucosa entirely escape; in the severer cases there is always some transudation into the meshes of this tissue. When this is present, a comparatively slight exacerbation of the inflammatory process may increase the transudate to the extent of producing very great swelling of those regions of the larynx in which the loose cellular tissue is abundant (ventricular bands, ary-epiglottic folds). This is rare in primary acute laryngitis, but quite common in the secondary forms; the extension, for instance, of phlegmonous disease from the pharynx, or when the laryngitis is merely a local manifestation of systemic disease (syphilis, typhus, tuberculosis, traumatic sepsis, etc.). In such cases the infiltrate is a dense sero-purulent matter, and not a clear serous fluid, as in the simple "hydrops laryngis" sometimes observed in the course of nephritis or obstructive disease of the heart (Perls). Fauvel and Oertel have found œdema laryngis an early and frequent form of dropsy in Bright's disease. Morell Mackenzie states that in 1872 he examined the throat in two hundred cases of Bright's disease, and failed to find any trace of œdema in a single instance.

Sestier in 1852 produced a monograph on œdema laryngis, based upon the records of two hundred and forty-five cases of this disease. We have never seen his work, but know its character and conclusions only through reference by subsequent writers, principally Türk and Morell Mackenzie.¹

According to Sestier, simple catarrhal inflammation was the cause of œdema in six per cent. of all the cases included in his report. If it be remembered that his work was done before the invention of the laryngoscope, that more than eight-tenths of the cases referred to were gleaned from general medical literature, and that, up to the time he wrote, "œdema glottidis" was a term used to describe clinically nearly all forms of obstructive laryngeal disease, considerable doubt must arise as to the validity of his conclusions. He puts down, for instance, thirty per cent. of the cases examined as primary œdema laryngis. According to Cohnheim, œdema in primary catarrhal laryngitis is of very doubtful occurrence. Strübing has described two cases of "œdema laryngis fugax" in individuals who exhibited "general hyper-excitability of the vaso-dilators." Schroetter shrewdly suggests an analogy between this condition and the one underlying urticaria of the skin.

The swallowing of scalding liquids or caustic solutions, and the presence of foreign bodies, are among the possible causes of œdema. At a meeting of the Clinical Society of Baltimore, September, 1878, I reported the "autopsy of a suicide by the swallowing of phosphorus." The subject was an epileptic imbecile, nineteen years of age. In addition to the lesions of the mouth, gullet, and stomach, there was found extreme œdema of the epiglottis, ventricular bands, and the greater part of the trachea. That this condition was ante-mortem was indicated by the fact that the immediate cause of death was apnœa.

In spite of the clinical evidence to the contrary, Von Hoffmann² declares that "acute œdema laryngis" is never a primary affection. His assertion is based upon the careful examination of six thousand and sixty-two autopsies made at the Berlin Charité (1869-71), among which laryngeal œdema was found thirty-four times; it was secondary to—

Heart-disease	9 cases.
Kidney-disease	8 "
Phthisis	5 "
Abscess of the neck	3 "
Tubercular ulceration of larynx	2 "
Traumatic ulceration of larynx	2 "
Septicæmia	2 "

¹ We cannot refrain from remarking the admirable richness of Mackenzie's well-known book in the matter of the literature of throat-diseases. It is a labor for which few have the necessary industry, knowledge, or facilities, and which is yet of incalculable importance for any work that aims at being comprehensive. Mackenzie's chapters on the history of the various diseases of the throat are so full and exhaustive that probably such work will never be done again, except by a careful observer for a period that begins where he left off.

² Berlin Dissert., 1872.

Syphilitic ulceration of neck	1 case.
Diphtheria	1 “
Fracture of thyroid cartilage	1 “

Scattered through the literature of this subject are to be found a number of cases in which œdema had suddenly made its appearance, either early in the course of an apparently mild simple laryngitis, or presenting by itself the first evidence of throat-disease. In point of fact, the possibility of sudden œdema is the only element of danger in simple laryngitis.

Fisher, in a report of twenty-four post-mortem examinations in erysipelas of the head, found the pharynx and larynx implicated three times. Türk, Massei, Krishaber, and Biondi have each reported cases of primary erysipelas of the larynx.

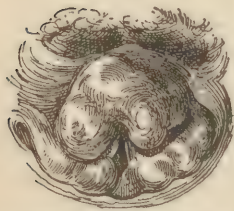
Shurly, Ingals, and Lennox Browne first drew attention to a form of laryngeal catarrh observed rather frequently during the course of acute rheumatism. Except for the prominence of severe pain, this form presents in its early stages little to distinguish it from ordinary acute laryngitis.

In the laryngitis of tuberculosis, chronic œdema, or rather œdemoid infiltration, is quite characteristic, and precedes, in many cases, the stage of ulceration. Usually it is limited to one or both arytenoids, but it may extend to the ventricular bands, the ary-epiglottic folds, and even to the epiglottis. It may also occur with syphilitic, lupoid, and cancerous ulceration, and in inflammation, from whatever cause, of the cartilages of the larynx.

The laryngoscopic appearance in œdema is very striking, and the dropsical region cannot escape recognition for a moment. The swelling may completely mask the deeper larynx, and by rapid accession produce extreme dyspnœa. Fig. 4 depicts an œdema that developed suddenly on the fourth day of a laryngitis caused by the inhalation of flame. Tracheotomy relieved the dyspnœa, but the man died twenty-seven hours after the operation, with cerebral symptoms; the head and shoulders were the seat of very deep burns received during the man's escape from a burning hotel.

Gibb, Mackenzie, Cohen, and others report cases of sub-glottic œdema—that is, an œdema of the mucous membrane immediately below the cords—in acute catarrhal laryngitis. (Fig. 5.) This form may be encountered alone or in conjunction with œdema of other laryngeal structures. It is quite rare in catarrhal laryngitis, though tumefaction of this region is not uncommon in the chronic laryngitis of tuberculosis; and we have now under observation a case of primary lupus of the larynx in which the epiglottis and the sub-glottic

FIG. 4.



General œdema laryngis from burn.

FIG. 5.



Sub-glottic œdema. (Cohen.)

region are the only parts affected. (Fig. 6.) The epiglottis has been almost entirely destroyed by ulceration. The cicatrices of healed ulcers, side by side with recent lumpy infiltration, so characteristic of this disease, are well marked. The sub-glottic œdema (recent) is principally confined to the right side.

The several forms of paresis of the cords encountered in acute laryngitis will be considered later.

Subjective Symptoms.—In a preceding section have been described the symptoms and laryngoscopic appearances in the ordinary form of simple catarrh of the larynx: what is set down here, therefore, is to be considered applicable more particularly to the severer forms of this disease.

Pain, amounting, however, in many cases to a feeling of discomfort only, is always present, and is often the first indication of disorder. In the beginning it is usually described as a parched, burning sensation, and is aggravated by deglutition, cough, and use of the voice. In severe cases the pain is very acute and radiates towards the upper pharynx and the ears. The cartilages are tender to touch, and pressure upon the wings of the thyroid is likely to bring on spasmodic cough. Some fever and headache and a general malaise are present, but never very pronounced unless the affection be of the phlegmonous variety, or associated with tonsillitis or submucous pharyngitis.

The character of the secretions has already been adverted to.

Even in the early stage, when there is almost no secretion, *cough* is a troublesome symptom. It is short, dry, metallic, and shallow,—peculiarities which make it easily recognized as of laryngeal origin; indeed, the cough is in a measure voluntary. As the secretion grows more abundant, the cough becomes moist, more frequent, and of longer duration; when the secretion has reached a purulent stage, the cough usually ceases to be painful.

It is probable that the acoustic quality of the cough depends quite as much upon the habit of the individual as upon the nature of his disorder; that is, the tone of the cough is an index rather to the position of the palate, tongue, lips, and cheeks—the calibre and conformation of the “chambers of resonance”—than to the condition of the larynx. Of course the pitch of the sound will depend mainly upon the thickness and tension of the cords. There is a peculiar cough (much more common in children than in adults) in some cases of acute laryngitis, which is due to a sort of clonic spasm of the glottis, and which is quite different from the familiar “croupy” cough. This spasm occurs in both “moments” of the cough—the inspiratory and expiratory moments—and gives the cough a staccato effect. This peculiarity, however, is at times present in tracheitis when the larynx is entirely normal.

FIG. 6.



Lupoid ulceration of epiglottis, and sub-glottic œdema.

Respiration is not actually affected, except in cases attended by an unusual amount of swelling of the cords, or when œdema is present. Patients often complain of *embarrassed* respiration, when in point of fact it is only somewhat *painful*: they fancy that breathing is impeded because they are made conscious of an otherwise unconscious act by the pain that now accompanies it.

Alteration of voice is an early and constant symptom; it ranges from slight huskiness to complete aphonia. Not only is it present in those very slight cases of catarrh which heal spontaneously in a few days, but it is often the only obtrusive symptom in fugitive hyperæmias of the larynx that never develop into true catarrhal inflammation. Hoarseness, due to loss of tension in the cords, even before the appearance of hyperæmia, is not uncommon. Morell Mackenzie approvingly quotes Gerhard¹ thus: "When the patient attempts to vocalize there is a defect of parallelism of the cords, their free margins presenting a concave outline, and forming an open glottis inconsistent with perfect phonation. This condition, as Gerhard points out, is often caused by palsy or paresis of the thyro-arytenoid muscles, and indicates an early change in the nerve-supply of the intrinsic muscles. . . . It may be remarked that the derangement of motor function often precedes the superficial hyperæmia. . . . The alteration of voice thus brought about points unmistakably to an interference with the innervation of this region as the initial step in some cases of inflammation." (Fig. 7.)

FIG. 7.



Paresis of the vocal cords.

Schroetter² is quite positive that the paresis observed following or during the course of acute laryngitis is due solely to "an infiltration of the intrinsic muscles of the cords." There can be no question that this is often the case, and that the incompetence of the glottis is a mechanical one, caused by exudation between the muscular fibres that prevents their adequate contraction. There is, however, abundant evidence at hand to prove that in many cases the "oval glottis" is produced by a paresis of the thyro-arytenoidei interni, of nervous rather than of mechanical origin. Unequal swelling of the cords makes a raw, hoarse, breaking voice, and renders the cough deep in tone. Swelling of the mucous membrane in the inter-arytenoid space to a degree that interferes with the closing of the cartilaginous glottis is among the rarer causes of hoarseness. Complete aphonia is unusual, except in the case of hysterical individuals. Total paralysis of the cords is witnessed at times. It is very instructive to observe what an effort—often successful—is made by the ventricular bands to form an embouchure when the cords are not completely paralyzed, but yet are too weak to produce tone.

¹ Handbuch d. Kinderkrankh., 1878, Band iii., Heft 2, p. 322.

² Vorlesungen ü. d. Krankh. d. Kehlkopfs, etc., 1890, Vorl. vii., p. 62.

(The term "false cords" is almost entirely fallen into disuse; perhaps undeservedly, for it should not be forgotten that the term had a physiological if not an anatomical *raison d'être*. The ventricular bands always approach the median axis of the larynx and form what may be called a "surrogate glottis" when for any reason the cords are incompetent.)

With certain people—male and female—of an hysterical habit, complete aphonia attends a very slight degree of paresis. Perhaps, as has been suggested by Semeleder, we think, the fault is here a paresis of the will (*willens-parese*). The weakness of the cords sometimes persists for a long time after all signs of inflammation have vanished, and when the larynx appears, but for this one defect, to have returned to an entirely normal condition.

During the last two visitations of la grippe (San Francisco, 1889-1891) I observed a number of cases in which complete unilateral paralysis of the larynx persisted for months after the subsidence of all other symptoms. These cases will be again mentioned under the head of treatment.

Acute Laryngitis of Young Children.—In very young children catarrh of the larynx is a far more serious disease than in adults, in respect both of the symptoms immediately caused by the inflammation in the larynx, and of the constitutional disturbance. The terms "false croup," "spasmodic croup," "stridulous laryngitis," although chosen for this affection at a time when its true nature was partly misapprehended, have yet been retained, because each designates in a very graphic manner some pronounced clinical feature of the disease.

In most cases acute laryngeal catarrh in children presents nothing distinctive, but often its course is punctuated by nocturnal attacks of spasm of the glottis. The affection usually commences as an ordinary cold, which soon gives evidence of having extended into the larynx, or the signs of a mild laryngeal catarrh may be first to attract attention. There is hoarseness, with fever and restlessness, but not enough to excite alarm. At night, however, the distinctive character of the disorder becomes manifest. The child is awakened from a quiet sleep by a paroxysm of suffocative cough, during which breathing is stridulous and labored; the face becomes purple, the eyes red and staring, the veins in the neck swollen and turgid. The cough is very peculiar. It has the deep, sharp, barking tone characteristic of laryngeal obstruction, but, in addition, the explosive expiration is broken in upon by short, quick, shallow, sobbing inspirations. (This feature may be observed also in chorea laryngis.) After a varying period—a few seconds or a few minutes—of apparently imminent suffocation, the attack gradually subsides, to recur once or twice before morning, or perhaps not until the next night. As a rule, the croupy seizures are all nocturnal, and during the intervening days the patient exhibits only the symptoms of a mild laryngitis.

A laryngoscopic examination, even if made immediately after a paroxysm, discovers nothing other than the ordinary picture of simple catarrhal inflammation. With certain children, every laryngeal catarrh is attended

by such attacks; yet I cannot agree with Ziemssen, who believes that they are always the "evidences of unusual vulnerability of the respiratory mucous membrane in children who have an hereditary predisposition to scrofula and phthisis, or who have been reared effeminately." I believe rather that they are the expression of that general instability of the nervous apparatus which is so often observed in young children, and which occasions a proneness to reflex convulsive seizures.

Tobold has said, "in all inflammatory diseases of the air-passages the danger to life stands in inverse ratio to the age of the patient." This statement is in a great measure true, and an appeal to mortuary statistics would probably confirm it; and yet the reasons given by Tobold are not satisfying. He thinks the gravity of the symptoms depends entirely upon the "smallness of the glottis, and the consequent greater likelihood of stenosis resulting from a moderate degree of swelling in the laryngeal structures." According to Richerand and Kölliker, the development of the larynx goes on at pretty equal pace with that of the other organs until the third year, when there is nearly total arrest of its growth until the twelfth; in other words, from the third until the twelfth year the larynx remains almost stationary in its development. The relative gravity of the disease in children is certainly not wholly due to the narrowing of the laryngeal orifice by swelling of the mucous membrane and the impaction of inspissated secretion in the glottis. That these conditions are present in some cases, and add materially to the danger of the spasmodic seizures, may not be doubted, but it is equally certain that in typical cases the stenosis is, in the main, caused by spasm of the laryngeal constrictors. Due weight is accorded to this factor in the affection by Cohen,¹ who asserts that the alarming symptoms presented in young children, even when the inflammation is strictly limited to the mucous membrane, "is partly due to the greater delicacy and sensitiveness of the tissues, but also, in great measure, to the greater sensitiveness and excitability of the nervous system. Thus, phenomena of spasm, whether direct or reflex, will be more severe in themselves, and, on account of the small size of the glottis, more dangerous in their results. In like manner, paralysis of the glottis, preventing full inspirations, is more quickly followed by pulmonary and cerebral congestion. . . . In some cases the local nervous phenomena are those of paralysis instead of spasm. There is great difficulty of inspiration, as indicated by stridor, violent action of the auxiliary muscles of respiration, orthopnoea, rigidity of spine, retraction of head, and recession of the soft parts above the sternum, below the thorax, between the ribs, and even implicating the ribs themselves in severe cases; expiration being performed with comparative freedom, or even without effort."

Although there can seldom arise any difficulty as to diagnosis in this affection, the laryngoscope should always be used, in order that membranous

¹ Diseases of the Throat and Nasal Passages, 2d ed., p. 430.

disease may be excluded by inspection of the parts. With the aid of Blount-Dyer's tongue-depressor for forced laryngoscopy, it is possible to use the mirror even in infants a few months old.

The treatment, as far as the laryngitis is concerned, need not differ materially from that followed with adults. Great pains, however, should be taken to discover and remove any remote cause for the spasmodic seizures, which are probably oftenest of a reflex character. Intestinal worms, intestinal obstruction, the irruption of teeth, irritation in the external ear, localized eezemas, etc., are among the possible excitants.

TREATMENT.

From what has been said in the section on etiology, it follows that the most rational prophylaxis for all forms of idiopathic laryngitis is the avoidance of taking cold. With individuals, therefore, who exhibit a peculiar susceptibility to catarrhal inflammation, it is of the greatest importance that they adopt in some measure what has been termed "the hardening process." I have had occasion above to refer to Bosworth's excellent chapter on this subject, and the advice there set forth so well summarizes what I consider of most value in the matter that I do not hesitate to quote it rather fully.¹ "Perhaps the most important direction that can be given in regard to preventing colds is as to the proper regulation of the clothing. The body should be sufficiently clothed for warmth and comfort, no less and no more. If too little clothing is worn, there will necessarily result a loss of animal heat. If too much is worn, the body becomes overheated, and perspiration necessarily ensues to reduce the temperature and restore the proper equilibrium, and consequently a condition arises in which the body is extremely sensitive, and in which it is especially liable to succumb to the influence of cold or moisture. This rule in regard to clothing the body applies to all parts of it. The mistake should always be avoided of coddling any portion or of leaving any portion insufficiently protected. A very pregnant and common error is fallen into by many, of crowding too much clothing upon those portions of the body which they suppose to be subject to some special weakness; as, for instance, many people, supposing themselves to have weak lungs or throats, fall into the error of piling wrap upon wrap, muffler upon muffler, around their necks and about their chests, thereby encouraging the very condition which they fear, and incurring the risk they desire to avoid; for the excessive muffling of the parts necessarily leads to perspiration, and consequently the danger of its being suddenly checked upon the removal of the wraps. I know of no more prevalent mistake, nor one which is a more prolific source of mischief, than the habit which prevails to so great an extent among us, of muffling up the neck. Especially is this the case when a cold is contracted

¹ Op. cit., p. 57 *et seq.*

which develops in a sore throat. There could be no greater error than to suppose that mufflers about the neck protect the throat, or that the chest is protected in any way by extra thickness of covering about it. Indeed, the contrary is quite true. Perhaps the very worst place in which to wear the so-called chest-protectors is on the chest. The chest is infinitely better protected, in one liable to bronchial attacks, by an extra sole worn on the boot than by a felt pad worn across the chest. The whole theory of clothing should be based on the idea that exposure to cold results in an interference with nutrition in some part of the body. Therefore, to prevent taking cold, the heat-producing force of the body should be thoroughly and equally protected in all parts; in other words, the clothing should be uniformly distributed over the body, with simply enough of it for comfort and absolutely no more. . . . We protect ourselves from absolute cold by wearing clothing, but not from taking cold. We protect ourselves from taking cold by so regulating our habits of life as regards clothing, etc., that we expose ourselves to changes of temperature with impunity. In other words, we inure ourselves to the climate. Perhaps no better aid to this is afforded than in the use of the bath. I think the direct connection between the daily use of the bath and the avoidance of taking cold will be clearly understood if what has been stated is true,—viz., that taking cold is a disturbance of the heat-producing forces, and, furthermore, that the nice adjustment of the animal heat in the body is regulated by the function of cutaneous transpiration, and hence depends on the healthy functional activity of the skin. Perhaps we have no better way of maintaining this functional activity than in the daily use of the cold bath. For those whose physique is equal to it, the daily use of the cold plunge- or shower-bath is to be recommended as the best protection possible against taking cold. If this is not well borne, it is indicated clearly by the feeling of lassitude and chilly sensations which follow the use of the bath; the contrary being indicated by the sense of warmth and general invigoration which attends its use. If the plunge or shower is not tolerated, the cold sponge, either of the whole body or to the waist, is to be commended. The time at which the bath should be used is preferably in the morning, in that not only is the night sleep a better preparation for it, but also the exhilaration and vigor which follow is an excellent preparation for the labor of the day." To this may be added that all children from their earliest infancy should be accustomed to the daily cold bath, unless the practice be contra-indicated by a frail physique or systemic disease.

It is often possible to abort an acute laryngitis, especially in those cases where the larynx early shows signs of becoming implicated by the extension of simple catarrhal inflammation from the nares and pharynx. The internal administration of quinine, opium, pilocarpine, or atropine, the topical application, by insufflator, atomizer, or steam inhaler, of carbolic acid, cocaine, or boric acid, etc., have been proposed by and proved efficient in the hands of various practitioners. Morphine and pilocarpine, given

subcutaneously, and camphor vapor by inhalation, have in my own experience been found most generally useful.

The following plan has been of special value. A prompt, brisk saline cathartic (a double Seidlitz powder, for instance) is given, to be followed by a hearty meal. After the first movement of the bowels, morphinæ sulph. one-eighth grain is administered hypodermically, and the patient directed to suck ice until the throat-dryness caused by the morphine has passed away; inhalations of camphorated steam to be made every half-hour. I have found this method particularly useful in the case of singers and public speakers, who so frequently apply to the specialist for the relief of beginning hoarseness which threatens to incapacitate them for some important engagement.

Even when the catarrhal process in the larynx has become pronounced, it can often be cut short in a night by a purge, a subcutaneous injection of pilocarpine mur. one-third grain, and a Priessnitz pack; the diaphoresis may be advantageously assisted by the use of extra bedclothing.

Of course none of the many methods employed for aborting "colds" are always successful. The immediate effect sought is the same with them all,—viz., the prevention or the dissipation of localized congestion by a counter-determination of the blood; and no doubt here too, as in all other vital phenomena, the peculiarities of the individual will be decisive for success or for failure with one or other particular method.

The use of strong solutions of silver nitrate,—twenty-five to fifty per cent.,—as was originally proposed by Gibb, and is even now advocated by Störk and Fränkel, for the rapid resolution of an acute laryngitis, should be mentioned only to be condemned. I believe that the use of caustics in acute laryngitis has been almost entirely abandoned by laryngologists, and with one or two exceptions has been earnestly decried by all modern writers; yet many general practitioners of to-day, either in ignorance of, or in direct opposition to, the voice of experience, apply concentrated solutions of silver nitrate to all cases of laryngitis. Nothing is more certain than that such practice is not only useless but even positively harmful.

As has been indicated above, in mild cases of acute laryngeal catarrh there should be no question of local treatment at all. When one has advised rest for the voice, as absolute as possible, the avoidance of whatever may have a deleterious influence upon inflamed mucous membrane (cold, damp air, irritant vapors, tobacco-smoke, ingestion of alcoholic liquors, etc.), and has given soothing, demulcent drinks, or an anodyne to allay distressing cough, one has done all that can be useful, all that is safe, for such cases.

Even in the severer forms an over-active interference is to be deprecated, especially in respect of local medication. The treatment should be principally symptomatic, and the indications supplied by the laryngoscope must have special weight. Complete rest of the voice should be enjoined, particularly upon professional voice-users. In mild cases, confine-

ment to the house, except during inclement weather, is neither necessary nor judicious. In severe cases, attended by pronounced febrile disturbance, the patient should be kept in a comfortably warm room until the acuteness of the attack subsides.

In the early, dry stage, after an attempt to abort the attack has failed, some means should be adopted to stimulate secretion. For this purpose muriate of ammonium and iodide of potassium are most prompt and effective. The iodide may be given in rather full doses, well diluted,—twenty to thirty grains in four or five ounces of hot water, to be repeated at intervals of three hours until its action becomes pronounced; two or three doses usually suffice. Ammonium muriate in the form of troches may be given *ad libitum*. Later, when the laryngeal secretion is more profuse, but still gummy and tenacious, frequent spraying with diluted Dobell's solution or plain salt water is of use to liquefy it and favor its easy expulsion. The hard, painful cough is best relieved by small, frequently-repeated doses of codeia, one-eighth to one-quarter grain, in syrup.

For the pain in swallowing and the tenderness of the whole larynx, extending sometimes to the muscles of the neck and occiput, the ice-bag, cold compresses, and the water-coil afford most relief, though occasionally warm applications are preferred. The constant sipping of hot drinks, so generally recommended, though often grateful to the patient, undoubtedly retards resolution when congestion of the laryngeal mucous membrane is intense and abrasions have made their appearance. Under these conditions, iced liquids are employed to much greater advantage. When the mirror discovers the superficial erosions nearly always present in the later stages of severe cases, the time has come for active local treatment. Here the effect of a weak solution of chromic acid—five to ten grains to the ounce—is little less than magical. These applications, best made with the cotton brush, should be preceded by spraying with cocaine muriate ten per cent., not for the purpose of anæsthesia (for chromic acid in this strength is not painful), but to deplete the laryngeal investment, because the effect of the acid is most prompt and efficacious when applied to depleted mucous membrane. This same procedure is of service, even in the absence of erosions, in cases marked by considerable tumefaction of the cords or ventricular bands, or when, after the subsidence of acute symptoms, the inflammation evinces a disposition to assume a chronic form.

The application of leeches to the neck and sternal notch, or venesection at the arm, has been advised. In my opinion, such measures are worse than useless.

Œdema of any of the laryngeal structures, though of the greatest rarity, is a complication so grave that the merest possibility of its occurrence lends importance to mild cases. For this reason *every case* must be carefully watched and frequently examined *laryngoscopically*. If œdema make its appearance, the tissue involved should be freely scarified immediately, and no time wasted in a trial of less radical measures. If the infiltrate be

simply serous, it will flow freely from the wounds; if not, it may be assisted in its egress by pressure. Ordinarily the scarification need not be repeated, as relief of all the symptoms occasioned by the œdema is prompt and lasting. If, however, the swelling do not subside, or if the infiltrate prove to be dense, or of a purulent character, the trachea should be opened at once.

The paretic condition of the cords (Fig. 7), often developed even in mild cases, may persist for a considerable length of time after all other signs of disease have disappeared. The origin of the paresis is obscure; whether a pure neurosis, or an incompetence of the thyro-arytenoidei interni, caused by infiltration of the muscular fibres, is very difficult to determine. It slowly disappears, and is not apparently affected by any form of treatment. During the prevalence of epidemic influenza (1889-91) I had occasion to observe a form of paralysis following acute laryngitis, quite new to me in that connection. I have notes of nine cases in which complete unilateral paralysis of the larynx made its appearance during the course of simple laryngitis and persisted for from five to fourteen weeks after all other symptoms had subsided. The paralysis was right-sided four times, left-sided five times; all the cases were adult males between twenty-three and fifty-one years of age, except one, a girl aged twelve years. Galvanism, strychnine, and massage were employed, but with no apparent effect upon the course of the trouble. Complete restoration resulted in every case.

As for the diagnosis and differentiation of the various forms of laryngeal inflammation, the laryngoscope has removed all difficulty.

The prognosis in the acute primary disease is, almost without exception, favorable; the possibility of œdema constitutes, perhaps, its only element of danger to life.

The laryngitis secondary to eruptive febrile disorders, so far as it agrees in type with the disease here considered, presents no features calling for special mention that have not already been adverted to.

CROUP.

BY WILLIAM CARR GLASGOW, M.D.,

Professor of Practice of Medicine, Diseases of the Chest, and Laryngology, Missouri Medical College, St. Louis, Missouri.

IDIOPATHIC MEMBRANOUS CROUP.

MEMBRANOUS croup is an idiopathic inflammatory affection of the mucous membrane, characterized by an exudation of coagulated fibrin, forming a membranous covering on the surface of the mucous membrane. The extent of the exudation varies in different cases: it is most frequently confined to the larynx. In some cases it is found also in the trachea, the bronchi, and rarely in the nasal cavities. The coagulated exudation is composed largely of fibrin from the vessels and migratory disintegrated white blood-corpuscles.

It may be a primary disease, or it may be secondary, produced by causes which excite intense inflammatory action, destroying the epithelial layer of the mucous membrane.

We find a secondary croup-membrane occurring as a result of various kinds of traumatism. It may be the result of the application of irritants to the mucous membrane in the form of caustics (Weigert). It has followed the application of the galvano-cautery. The writer has seen it as the result of an application of chromic acid to the nasal mucous membrane. Oertel¹ produced a croup-membrane in seventeen animals by dropping a few minims of liquor ammoniæ into the trachea. It has been produced by the inhalation of irritating gases and hot steam.²

A croup-membrane may also be produced through the effect of many specific poisons. It is seen occasionally in the early stage of scarlet fever independent of any diphtheritic influence. In measles, croup occurs occasionally as a complication. Rauchfuss cites thirteen croup cases among eleven hundred and seventy-six cases of measles. In variola the croup-membrane has occasionally been observed. Gottstein remarks that it is more frequently seen in the larynx than the pustular eruption. Liebermeister notes the occasional occurrence of a secondary croup-membrane in typhus fever, typhoid fever, cholera, and puerperal fever. In the late epidemic of influenza the croup-membrane was occasionally seen in the larynx or pharynx.³

¹ Ziemssen's Cyclopædia, vol. ii.

² Liebermeister, *Speciale Pathologie u. Therapie*.

³ Septic Œdema of the Air-Passages, New York Medical Journal, August 10, 1889.

In diphtheria a croup-membrane in the larynx is of frequent occurrence. It is rarely primary, and is generally due to an extension of the exudation of a pharyngeal diphtheria. Northrup¹ states that among one hundred and fifty-one cases of diphtheria in only one case was the membrane limited to the larynx. In eighty-eight there was evidence that the membrane made its appearance first in the larynx, or at the same time as in the pharynx.

Membranous croup occurs as an idiopathic inflammatory disease caused by certain so far unrecognized atmospheric or telluric influences. Places which are damp or badly drained, with a cold, moist sub-soil and exposed to piercing and humid winds, have developed the largest number of cases. Squires² thus describes the classic croup district of Scotland: "The eastern coast is deeply indented by the sea, and not only do the deep valleys of clay extend from their firths, but their shelving shores leave a great expanse of ooze uncovered at every tide. During the easterly winds that here prevail for three months of the year with great bitterness, the characteristic cases of Scotch croup occur." The mortality often exceeds two per cent.

Idiopathic membranous croup occurs more frequently in the country than in the cities: hence it is more generally recognized by the country practitioner than by his colleagues of the cities. It is probable that the atmospheric and telluric influences favorable for its development excite the toxic effect more readily in the isolated farm-houses and scattered villages than in the closely-built, more protected, and better-drained areas of the city. This is true in regard to malaria, and may be equally true in regard to membranous croup. Types of disease also change as the sparsely-settled undrained country districts become more thickly populated, when the sanitary conditions are improved by the better drainage of the land, the cutting down of the forests, and more thorough methods of cultivation of the soil. In the Illinois bottom-lands malaria has given place to tuberculosis, and the idiopathic membranous croup of former years has, according to the statements of the old country practitioners of the district, been largely displaced by the more modern diphtheritic croup.

Another reason to account for the disappearance of membranous croup from localities where it formerly prevailed may be found in the antagonism of disease. It certainly prevailed extensively in England prior to the great epidemic of diphtheria in 1858. The older writers, Home,³ Cheyne,⁴ Abercrombie,⁵ and Watson,⁶ fully described it, and recognized a difference between it and the new disease. This is quaintly expressed in the language of Home, reported by Johnstone, in which he illustrates in a forcible manner the dissimilarity of the two diseases as they were then recognized: "Two very different situations of the suffocatio stridula: the former more

¹ Cyclopædia of the Diseases of Children, vol. ii.

² Reynolds's System of Medicine, vol. ii.

³ Ibid.

⁴ Ibid.

⁵ Ibid.

⁶ Watson's Practice of Physic.

inflammatory and less dangerous, the latter less inflammatory and highly dangerous. In the former the pulse is generally strong, the face red, the drought great, and they agree with the evacuations; in the latter the pulse is very quick and soft, great weakness, tongue moist, less drought, great anxiety, and evacuations hasten death." The statistics of Dr. Farr¹ (Report to the Registrar-General between 1855 and 1870) show a striking diminution of croup and a great increase of diphtheria during these years.

William Squires, in his classical article on croup, based on a report of the Registrar-General of England, including ninety-five thousand cases of croup during a period of twenty-five years, has shown the individuality of croup when compared with catarrhal diseases of the respiratory organs. He finds a strong contrast when it is considered in reference to prevalence and mortality. Its times of prevalence agree more nearly with those of pneumonia and certain of the exanthemata, notably measles. He places croup in an intermediate place between diseases of the respiratory organs and the zymotic class of diseases.

Membranous croup affects children from infancy to the tenth year,—more frequently occurring in the second year. The attack is occasionally repeated. It is non-contagious, non-inoculable; it always occurs in a sporadic form. Through some unknown cause certain families and certain members of the same family are more disposed than others to the disease. Vigor or weakness of constitution seems to have no influence in promoting it. Statistics show a greater number of male than female children affected with croup.

Symptoms.—The symptoms of membranous croup usually arise in a comparatively sudden manner; they may be delayed a few days or they may occur soon after exposure. The child seems indisposed and feverish, showing signs of a simple catarrhal attack; a slight hoarseness may be present, with an occasional cough, such as occurs in simple laryngitis. During the night of the first and second day, usually towards midnight, attention is attracted to the child by the hoarse croup cough; it is at first resonant, strong, and metallic and occurs as a single cough at intervals; the cough may occur sometimes without awakening the child; soon, however, it becomes more frequent, and the child awakens frightened, with more or less difficulty of breathing. The inspiration is prolonged and assumes a characteristic crowing sound, and all the signs of obstruction in the larynx are evident. This attack may last a few minutes or a few hours, and as it passes off the child, exhausted, sinks into slumber. It may recur in paroxysms during the night. Towards morning there is usually a remission, and an uneasy sleep may be obtained. As the hours pass, the fever rises until the thermometer may show 103° or more. The voice grows hoarser and the cough more frequent; the dyspnoea increases and becomes permanent instead of paroxysmal; the pulse becomes more

¹ Reynolds's System of Medicine, vol. ii.

rapid and hard, and there is a general dryness of the skin and secretions; the face is flushed and swollen, the conjunctiva injected, the dyspnœa excessive, the child is restless and excited, and it makes constant efforts to grasp the throat, as if to remove the obstruction. When the paroxysm of cough comes on, the head is thrown back, the accessory muscles of respiration are brought into action, and the difficulty of breathing becomes extreme. Unless relief is given by expulsion of the membrane the suffering soon becomes continuous; the voice and cough lose all tone; the prolonged inspiratory stridor is accompanied by an equally long expiration; the dyspnœa is extreme, and cold sweats break out on the body and the livid face; cyanosis with coma comes on, and the child dies unconscious from suffocation.

If a successful expulsion of the membrane from the larynx is effected and no extension into the trachea or bronchi is present, a general amelioration of all the symptoms takes place, the breathing becomes freer, and the cough regains its tone and metallic character, gradually becoming softer and looser with expectoration.

In some cases the stridor and a certain amount of dyspnœa continue after the expulsion of all the membrane from the larynx.¹ This may be ascribed to paresis of the adductor muscles of the larynx, the result of the intense inflammation, such a condition as we occasionally see in acute laryngitis.

The duration of the disease varies according to the age and vigor of the child: it may terminate fatally in twenty-four hours or may continue for five or six days.

The mortality of membranous croup is large, but it is difficult to obtain statistics on the subject. The dogmatic assertion of many authorities, who deny the existence of croup as an idiopathic disease and who class all croup cases as diphtheritic, makes the task a difficult one. Hilton Fagge quotes the mortality of idiopathic membranous croup at sixty to seventy per cent. In this country many old practitioners who treated membranous croup before the advent of diphtheria claim more favorable results.

Diagnosis.—Membranous croup may be confounded with laryngismus stridulus, with spasmodic laryngitis, or with diphtheritic croup.

In laryngismus stridulus the absence of fever, the suddenness of the attack, the complete intermissions between the attacks, and the inspiratory stridor and cough, so essentially different from croup, will establish the diagnosis.

Spasmodic laryngitis, or false croup, shows a closer similarity of symptoms in the early stage. The absence of fever, the condition of the pulse, with the existence simply of a paroxysmal inspiratory stridor, are important points in diagnosis. In those cases of spasmodic laryngitis where a clonic spasm of the adductor or paresis of the abductor muscles of the

¹ F. Niemeyer.

larynx is present, the diagnosis may be established with the laryngeal mirror. When this is not possible, the retention of a certain tone in the voice and cough, the absence of membrane in the expectoration, and a less intense dyspnoea, will aid the diagnosis.

In laryngeal diphtheria an identical croup-membrane is found obstructing the larynx, and the diagnosis must be made by a consideration of the history of the case and the special symptoms.

The symptoms of membranous croup are those of a sthenic inflammatory disease; the symptoms of diphtheritic croup are those of a septic asthenic disease. In membranous croup the attack is more sudden, the fever as a rule is higher and more continuous, the pulse is hard and full, and the secretions are deficient. There is no albumin in the urine, and no subsequent paralysis. In diphtheritic croup the onset of the disease is more insidious, and is soon accompanied by septic symptoms, the pulse is weak and rapid, the glandular system is early involved, albumin is found in the urine, and subsequent paralysis is very common. In diphtheria the exudation of the pharynx will generally precede that of the larynx. Membranous croup is non-contagious, non-inoculable, and occurs in a sporadic form. Diphtheritic croup is both contagious and inoculable, and may occur as an epidemic.

Treatment.—The treatment of membranous croup will depend upon the age of the child and the stage of the disease. When seen at an early period, when the inflammatory swelling and spasm of the glottis are the prominent factors, efforts must be made to relieve these conditions. In older children active counter-irritation over the larynx will be useful. The application of small flaxseed and hop poultices will tend to allay the inflammation and quiet the spasm. Lennox Browne¹ advises the use of the Leiter coil for the continuous application of dry cold. Gottstein² advises the use of cold compresses or the application of the ice-bag: he also advises in exceptional cases where the child is vigorous the application of from two to six leeches to the upper part of the sternum, the number being determined by the age and strength of the child. As no medication has as yet been found efficient in aborting the disease, the internal medication in this stage will correspond with that of a catarrhal croup. Ipecac in small doses and camphorated tincture of opium will act as a relaxant and allay the irritable cough. Inhalations of vinegar will be grateful. When the membrane has begun to form, every effort must be made to loosen and expel it. There is a general concurrence of opinion on the value of moist air as an efficient agent in promoting the expulsion. The croup-kettle and the croup-bed have both given satisfactory results. The inhalation of the vapor of unslaked lime is warmly recommended. Cohen³ advocates the bromine inhalations recommended by Ozanam. It is only with older

¹ Diseases of the Throat.

² Die Krankheiten des Kehlkopfs.

³ Diseases of the Throat.

children that anything can be accomplished with atomized fluids. Where it is possible to use an atomizer the writer has found the greatest benefit from the use of the peroxide of hydrogen thrown directly into the larynx with the atomizer. The liberation of gas which takes place seems to raise the membrane from its attachment, and so facilitates its expulsion. Emetics have long been in favor as a means of loosening and expelling the membrane, and by some they have been used in the early stage on account of their relaxing effects and their power to clear the throat of accumulating secretions through the act of vomiting. Alum and ipecac in sufficient doses will usually cause prompt emesis: they are safe, and can be frequently repeated.

The yellow sulphate of mercury is strongly recommended, and sulphate of copper has been highly extolled. If the stronger emetics fail to dislodge the membrane it is hardly advisable to continue their repeated use. The use of pilocarpine, both internally and by hypodermic injection, has been praised, but care is necessary in its use, owing to its tendency to weaken the heart. Aside from its emetic action, it increases the fluidity of the secretions. Calomel has long been used with the idea of preventing and limiting the exudation, but its value is problematic. It certainly increases the secretions, and in this way exercises a beneficial influence. Lennox Browne¹ quotes Dundas Grant in a favorable report on the use of calomel given in the following routine: one grain of calomel every four to six hours, and a mixture containing three to five drops of wine of ipecacuanha and three to five grains of bromide of potassium every two hours.

Dr. Wetmore, of Waterloo, Illinois, who has had long and large experience in the treatment of membranous croup, claims the most favorable results from the following mode of treatment:

R Liq. ferri perchlor., gtt. xxiv;
Aque destil., ℥iv.

One teaspoonful every five minutes day and night, if necessary, as long as labored breathing continues, then gradually lengthen the intervals. He also advises that the temperature of the room be kept at 75° to 80° F., and that the room be constantly kept filled with the vapor of pine-tar or vinegar, also that the functions of the skin and kidneys be promoted and the patient be well nourished.

In many cases of membranous croup the operation of tracheotomy or intubation will have to be considered. As this subject is treated in another article, the writer will omit any extended remarks.

Unquestionably the conditions present in membranous croup offer more favorable results after a tracheotomy than those found in diphtheritic croup. If it should be a question of operation, the writer strongly advocates an early operation,—that is, an operation as soon as the symptoms of per-

¹ Diseases of the Throat.

manent laryngeal obstruction have been established. The great danger in these cases is the mechanical congestion and the subsequent rapid œdema of the bronchial mucous membrane caused by the obstruction in the larynx. This condition will give rise to harsh inspiratory sounds, with subcrepitant râles; a condition which may be misinterpreted to mean an extension of the membrane into the bronchi. Dilatation of the right ventricle, with heart-failure, has been the result of this condition.

SPASMODIC CROUP.—SPASMODIC LARYNGITIS.

Spasmodic croup occupies an intermediate place between membranous croup and laryngismus stridulus. It is the result of a catarrhal laryngitis associated with spasm of the glottis. It almost exclusively affects children, though occasionally it is seen in the adult.

Spasmodic laryngitis is caused by atmospheric influences such as produce other catarrhal inflammations. Humidity of the air and sudden changes of temperature seem to favor its development. The prevalence of acute catarrhal inflammations arising in a community at certain times seems to point to some germ-influence, and the good effect of germicidal remedies in controlling it would strengthen this theory.

The sudden chilling of a portion of the body, especially if this portion is perspiring, will tend to lessen the normal heat of the part and increase that of distant parts. Children are more exposed to draughts than adults; living the greater part of the time on or near the floor, where the temperature of the room is the lowest, they are exposed more readily to draughts and the chilling influences from doors and windows. Certain children are more prone to catarrhal attacks than others, and the children of certain families are especially susceptible. These differences appear to the writer to be dependent on constitutional weakness, such as we see in the strumous diathesis. In this the tendency of the inflammatory process is to a sub-acute or a chronic type. On slight exposure it becomes acute, with the symptoms of an acute catarrhal inflammation. These children suffer with obstructive lesions of the nose and naso-pharynx, with adenoid hypertrophies and enlarged tonsils. The mouth-breathing which is a result of these conditions favors the development of catarrhal inflammation of the larynx.

The spasmodic element of the disease is largely due to the same causes: the unstable condition of the nervous system in such children is productive of the reflex neurosis, and it is undoubtedly true that while in one child laryngismus stridulus may be the result of such pathological changes in the nasal and post-nasal spaces, in others it takes the form of a spasmodic laryngitis.

Symptoms.—The child goes to bed in good health. Perhaps a cold in the head may be present, or even a slight hoarseness. During the night the croup-cough is heard: it is harsh, metallic, and barking. This may be repeated, and with it there may be a certain amount of stridor on inspiration. In the larger number of cases this is the single symptom, and the child

wakens the next morning seemingly well. The slight croup-attacks may recur for several nights and then disappear. In other cases the attack is more severe; the child suffers with dyspnœa, a permanent stridor is heard on inspiration, and to this is sometimes added a prolonged, harsh, expiratory sound. This may continue during the night, and even for many days. The cough is frequent, and always dry, metallic, and barking, and the dyspnœa may be excessive. The voice is harsh, but never loses entirely its tone. A slight degree of fever may be present, or it may be entirely absent. The child may complain of pain referred to the upper sternal region, and is indisposed to exertion.

In the greater number of cases the catarrhal laryngitis with the spasmodic element constitutes the disease. In cases which are less frequent the intense inflammation produces paresis of the abductor muscles of the larynx, and we find the cords fixed in the median line, with respiration performed solely through the cartilaginous portion of the glottis. In one case the writer has seen a laryngeal obstruction caused by clonic spasm of the adductors.

T. K., twenty-five years old, came to the Mullanphy Hospital complaining of hoarseness with attacks of cough and suffocation. When first examined, the lungs and heart were found normal, and a laryngoscopic examination showed simply a catarrhal inflammation. At twelve o'clock at night a sudden attack came on, and the writer was hurriedly called. When seen a short time later, the patient was suffering intense dyspnœa, with marked stridulous breathing. A laryngoscopic examination showed the larynx congested, the cords approximated and stationary in the median line. Hot applications were made externally. These, with the inhalation of chloroform vapor, gave prompt relief. The next morning the man was seen again, and found to be breathing easily. He ate a hearty breakfast, and moved about his room. At eleven in the morning he had a recurrence of the attack, and before relief could be obtained he expired.

As illustrating laryngitis complicated with paralysis of the abductor muscles, the writer reports the following case:

"John B., aged ten years, had been unwell for two days with symptoms of laryngitis; he was slightly hoarse, with an occasional croupy cough. He was suddenly seized at night with intense dyspnœa, which continued in spite of all the efforts of the attending physician to relieve it. The writer saw the boy the next afternoon in consultation. He was in great distress, showing marked inspiratory and expiratory stridor, with excessive dyspnœa. On examination with the laryngoscope the cords were seen immovable in the median line; they were reddened, and the posterior surface of the larynx was in a condition of inflammatory œdema. Tracheotomy was advised. After operation there was complete relief of the dyspnœa. Soothing inhalations, with counter-irritation to the larynx, constituted the subsequent treatment. On the sixth day after the operation the action of the abductor muscles was restored, and the tracheotomy-tube was removed."

Treatment.—In the milder cases of spasmodic laryngitis very simple treatment is necessary. A drink of hot milk or of hot eau-sucrée will be grateful. Any of the numerous household remedies may be applied, and every means taken to promote the action of the skin. Small doses of paregoric and ipecacuanha will relieve the cough and spasm. Cold compresses to the larynx or the use of the belladonna ointment have been found useful by the author. Where the inflammation is more intense, hot poultices to the larynx and upper sternal region and the use of inhalations of compound tincture of benzoin and paregoric will be of service. The vapor bath, with the free use of hot drinks, by promoting the action of the skin will often give relief. In larger children the author has used small doses of phenacetin and salol with benefit. If paralysis of the abductor muscles or clonic spasm of the adductors takes place and shows a tendency to remain, tracheotomy ought not to be delayed.

SPASM OF THE GLOTTIS, OR LARYNGISMUS STRIDULUS.

Spasm of the glottis is a term used to define a spasmodic closure of the glottis due to a tonic spasm of the adductor muscles of the larynx.

It is strictly a neurosis, and, like other affections of the nervous system, may have a central or a peripheral origin. It is frequently seen as a localized convulsive seizure; at other times it is part of a general convulsive attack, and it may be accompanied by carpo-pedal contractions or tonic spasms of other muscles.

Etiology.—Spasm of the glottis is essentially a disease of childhood. It occurs most frequently during the first year, less frequently in the second and third years, and it is rare after the fourth year. In adults it is occasionally seen,—more frequently than a study of the authorities would lead us to believe. Boys are more frequently affected than girls: the accepted ratio is two to one. In adult life females are more frequently affected than males.

Hereditary predisposition is a noticeable cause in many cases. Agreeing with other forms of nervous disorder, an inherited tendency towards its development is observed in certain children from causes which in others would fail to develop the symptoms.

All observers agree that children affected with rickets are especially prone to develop spasm of the glottis. Fleisch¹ estimates that three-fourths of the children developing this disorder are the subjects of rickets. Steffen² believes that nine-tenths of the cases are so affected.

Aitken³ quotes Sir William Jenner: "All the cases of spasm of the glottis save two which have been under my observation were the subjects of rickets." Gill⁴ estimates that in fifty cases forty-eight are rickety. Jacobi

¹ Gerhardt's Handbuch.

² Ziemssen's Cyclopædia.

³ St. Bartholomew Hospital Reports.

⁴ Ibid.

believes that every case of spasm of the glottis occurring in children during the first nine months of life is due to cranio-tabes.

Any and all conditions which produce malnutrition of a child with an inherited tendency favor the convulsive seizure: hence it is most frequently seen in the houses of the poor, where, in addition to improper and innutritious food, faulty hygienic surroundings are apt to exist. It occurs also in strong, robust children in perfect health. In these cases the neurotic disposition seems to be the determining factor, and the attack is caused by reflex irritation, either central or peripheral. The nervous system of children during the first years of life is in a condition of unstable equilibrium, and is especially impressionable to reflex irritation. Slight causes are sufficient to produce disturbances which would not occur after the full development of later years. Sources of peripheral irritation will be found most frequently in the upper air-passages and in the gastro-intestinal tract. In acute catarrhal inflammation of the posterior nares and naso-pharyngeal space there is great sensitiveness of the peripheral nerves and a tendency to the formation of sensitive areas. Under such conditions any irritation may be followed by reflex disturbances. In older children we frequently have the night cough, in the adult, bronchial asthma, occurring as the result of such irritation, while in infants convulsive attacks are the rule. A current of cold air, the presence of retained acrid secretions, are sufficient to provoke the attack. During the night, while in the recumbent posture, the secretions have a tendency to fall backward, and thus produce irritation in the posterior nares, naso-pharynx, or pharynx. It is problematic whether the secretions ever fall into the larynx, as is so often stated, as the conditions are essentially different from those that exist when the child is taking liquid food. The simple contact of the swollen mucous membrane of the posterior part of the soft palate and of the uvula with the pharyngeal wall will often produce the same result. Lennox Browne¹ asserts that the presence of hypertrophied adenoid tissue in the pharyngeal vault will occasion the convulsive attacks. This is hardly probable unless this condition is associated with catarrhal inflammation of the membrane. Cohen² relates cases where an impaction of the epiglottis has been followed by spasm of the glottis. Dentition has been held accountable for many attacks of the disorder. The period of life at which this occurs is one of great nervous excitability in children, and it is not improbable that prolonged irritation of the gums will be sufficient to excite reflex action. Hughlings Jackson asserts that the spasm of the glottis seemingly dependent upon the irritation of dentition must be ascribed to rickets. Gastro-intestinal disturbance has long been held as a prominent exciting cause. The presence of undigested matter in the stomach and intestines is more frequently followed by general convulsions than by spasm of the glottis.

¹ Diseases of the Throat.

² Ibid.

Spasm of the glottis is seen with many of the inflammatory affections of the larynx. It is the essential factor in spasmodic croup or spasmodic laryngitis. In membranous croup and diphtheritic croup it occurs frequently, and greatly adds to the distress.

Symptoms.—The symptoms of spasm of the glottis vary in different cases, according to the degree of severity of the attack. A single catch of the breath, with an inspiratory stridor, is a frequent occurrence in infants: it may be the result of crying or fright, or may be caused by an infant being tossed into the air. Occasionally in nursing, the milk, flowing too rapidly, enters the larynx, and causes a slight spasm of the glottis. In other cases it assumes a serious form: in the middle of the night the child awakens with a long-drawn sibilant sound; this is soon followed by another, still longer in duration, and this is continued for a time, until suddenly all sounds cease, and the child ceases to breathe; the face becomes livid, the eyes staring and prominent, the veins turgid, profuse perspiration breaks out, and all the symptoms of impending asphyxia are present. In a moment the spasm gives way, a shrill, whistling inspiration is again heard, and the paroxysm is over. In some cases carpo-pedal contractions and a tendency to opisthotonos are observed. The paroxysm may recur the same night, or it may appear the following night in a milder form. A still more severe type is occasionally seen, in which the first warning is a prolonged inspiratory stridor, followed immediately by a complete closure of the glottis and all the symptoms of imminent asphyxia. After a short interval a crowing inspiration is again heard, and this is repeated with lessened intensity of stridor until respiration becomes easy. In a few cases the laryngospasm refuses to relax, and death quickly ensues. The spasm of the glottis may be the initial convulsion of a general convulsive attack. One attack of glottic spasm is apt to be repeated, and it may occur many times until the child passes the age of susceptibility.

Treatment.—In the mild attacks of spasm of the glottis no medical treatment is necessary. If the cause provoking the attack can be discovered, this must be remedied. In the graver form, immediate action is necessary. If the child is in bed it must be raised up and stimulants applied to the nostrils, cold water may be dashed into its face or on its chest, or it may be slapped on the back. If the child can swallow, an emetic will usually allay the spasm very quickly. Chloroform may be used with great caution, although children take it kindly. Steffen¹ advises the use of apomorphine hypodermically in older children. A thorough cleansing of the lower bowel by enemata will give good results. The warm bath, 95° F., may be used, and at the same time cold water dashed into the face. If time will allow, a catheterization of the larynx may be performed, and, as a last resort, tracheotomy. Fortunately, in a greater number of cases the spasm is relieved as soon as the blood becomes venous, but occasionally

¹ Ziemssen's Cyclopædia.

asphyxia occurs before the physician can be summoned. The general treatment must depend largely upon the individual case: if rickets is the cause the attention must be directed to this disease. Soltmann¹ strongly recommends the use of phosphorus in combination with cod-liver oil. In conditions of malnutrition different forms of tonic and supporting treatment are necessary, such as iodide of iron, and properly-selected nutritious food. Small doses of bromide of potassium or sodium, belladonna, and occasionally small doses of chloral, may be given at night. It is essential that any disorder of digestion be corrected and constipation be avoided.

SPASM OF THE GLOTTIS IN ADULTS.

Spasm of the glottis occurs in adults in a limited number of cases. As a primary neurosis it is rare, but as a secondary complication it is more frequent. It is associated with many cases of catarrhal laryngitis assuming the character of spasmodic croup.

In tubercular laryngitis and laryngeal phthisis it adds greatly to the distress of the primary lesion. Many of the suffocative attacks occurring in this disease may be ascribed to this cause. The mucous membrane becomes sensitive, especially that part covering the inter-arytenoid space, and any food or liquid impinging on this space, through a faulty co-ordination of the muscles of deglutition or of the epiglottis, quickly gives rise to the spasm. The secretions accumulate in the glottis usually at night, and the spasmodic cough and the laryngeal spasm are then apt to occur.

In the œdematous laryngitis of influenza, spasm of the glottis has occasionally been the cause of death. The writer has described these cases in an article read before the American Laryngological Society, 1889.

Spasm of the glottis occurs occasionally as the result of the introduction of foreign bodies into the larynx. All workers in laryngology have had experience of the spasm following the application of medicaments to the larynx. Certain persons are especially sensitive, the mere introduction of the brush producing a spasm. The application of nitrate of silver either in liquid or in powder is especially apt to bring on an attack.

When foreign bodies become lodged in the ventricle of the larynx, or even in the trachea, a spasmodic cough, or in some cases a true spasm, ensues. In a case seen by the writer in which a cockle-burr became impacted in the ventricle of the larynx, the spasm was very marked. Caustic and irritating applications to the pharynx and naso-pharynx have in the writer's practice produced spasm of the glottis.

Krishaber² and Semon² have drawn attention to the fact that with a paralysis of the abductor muscles there is a tendency to spasmodic contractions of the antagonistic muscles. Semon asserts that when paralysis of the abductor muscles follows a prolonged disturbance of their nerve-centre the

¹ Gottstein, *Krankheiten des Kehlkopfes*.

² Die Laryngealen Störungen des Tabes Dorsalis, H. Burger, 1891.

same cause is apt to produce an irritability of the ganglionic cells of the adductor.

Lennox Browne¹ asserts that "spasm of the glottis may be the result of faulty voice-production or other cause of varix of the vessels at the base of the tongue, and by hypertrophy of the lingual tonsil, and may then be represented by a species of tenesmus, similar to what is often observed under similar circumstances in the fauces and pharynx."

The paroxysms of dyspnoea occurring with laryngeal tumors are often the result of laryngeal spasm. This has been observed with small fibroid neoplasms, but it is seen more frequently in cases where large growths fill the larynx. In these cases it seems to be dependent on the accumulation of the secretions.

In asthma, laryngeal spasm occurs frequently as an interchangeable neurosis with the bronchial spasm. In a case seen by the writer the asthmatic attacks ceased entirely, and were superseded by daily attacks of spasm of the glottis, during one of which the patient expired. In another case, spasm of the glottis, spasm of the diaphragm, and bronchial spasm all appeared at times as interchangeable affections.

In aneurism of the arch of the aorta and thoracic tumors, spasm of the glottis occurs, the result of irritation of the recurrent laryngeal nerve. At an early period, when simple irritation of the nerve exists, the result of pressure of the tumor, a spasmodic cough or spasm of the glottis occurs; later, when the nerve-fibres have undergone a degeneration through the inflammatory action, a paralysis of the adductor muscle takes place. In the stage where the sensitiveness of the nerve is increased through the pressure, any form of peripheral irritation will be sufficient to provoke the spasm. This is especially true in a catarrhal inflammation of the larynx. In a case of aneurism of the lower third of the arch of the aorta occurring in the writer's practice, a paroxysmal cough and glottic spasm were the first symptoms. This was followed by paralysis of the left adductor muscle; later the laryngeal spasm again appeared, and it was repeated so frequently and remained so persistent that tracheotomy had to be performed. Even after tracheotomy the tendency to laryngeal spasm persisted for some time, and it was accompanied by a violent paroxysmal cough. This subsided, and was immediately followed by a rapid nervous breathing, evidently the result of spasm of the diaphragm. In this attack, which continued for twelve hours, the patient expired.

In tabes, spasm of the glottis is one of the essential factors in the "laryngeal crisis." Burger² describes three different types of the "laryngeal crisis," differing from one another in symptoms and severity. In the mild cases the spasmodic cough alone is present; in others, more severe, both cough and spasm of the glottis occur; and in a still graver form the spasm of the glottis is the predominating feature. The prolonged inspiratory

¹ Diseases of the Throat.

² Op. cit.

stridor is very marked, the dyspnoea is intense, and unconsciousness comes on quickly, unless the attack is relieved.

Spasm of the glottis also occurs in tetanus, chorea, epilepsy, and hydrophobia.

It occurs as one of the protean forms of hysteria. Girls at the age of puberty are especially prone to the attack. The climacteric period, when disturbances of the nervous system are so common, develops a large number of cases. In some the attack seems to be largely dependent on a central disturbance, in others a distinct source of peripheral irritation can be found. The writer has seen six cases in women at the menopause. In four of these a catarrhal laryngitis was the inciting cause, in one a malignant uterine tumor, and in one no cause except the period of life could be discerned. In the last case the attacks persisted for two years. There had been entire cessation of menstruation. After a profuse uterine hemorrhage they entirely disappeared.

Laryngeal vertigo is believed to be due to a spasm of the glottis. The real cause of the attack is still obscure. Charcot¹ believes it to be of a similar nature to Ménière's disease, dependent upon some peculiar irritation of the superior laryngeal nerve. McBride² ascribes the attack to a physical condition within the thoracic cavity, caused by complete spasm of the glottis occurring during full inspiration. Elsberg³ considers it to be a spasm of all the adductor muscles. In most of the recorded cases the attack has commenced with a cough, followed by a spasmodic closure of the glottis, giddiness, and in some cases loss of consciousness. Krishaber⁴ describes a case in which there was no cough, but a sudden spasm of the glottis and a sudden arrest of the muscles of respiration. Some of these cases bear a certain resemblance to a mild form of epilepsy: this is the view advanced by Gray,⁵ and epilepsy seems to have been the probable cause of the attack in the only case that has come under the observation of the writer. "A man forty years of age stated that he frequently awakened at night, usually after midnight, with a feeling of intense constriction of the throat and complete want of breath. He would spring out of bed, and, falling on the floor, would become at once unconscious. After a few moments he would revive and would be able to return to bed. The attack came on during profound sleep, without cough or any premonitory symptoms. There was nothing in the history or habits of the man to throw any light upon the cause of the attack." L. Bianchi⁶ asserts the epileptic nature of the attack, and states that he saw a patient in whom the spells of laryngeal vertigo were interchangeable with classical epileptic convulsions.

¹ Comptes-Rendus des Sciences et Mémoires de la Société de Biologie, 1876.

² Edinburgh Medical Journal, 1884.

³ Transactions of the American Laryngological Association, 1883.

⁴ Annales des Maladies de l'Oreille et du Larynx, 1882.

⁵ American Journal of Neurology and Psychiatry, November, 1882.

⁶ La Psichiatria, la Neuropatologia e le Scienze affini, 1883.

SYMPTOMS OF LARYNGEAL SPASM IN THE ADULT.

The characteristic symptom is a long-drawn, sibilant, or crowing inspiratory sound, followed by a short, harsh, expiratory sound. It may continue for a few moments, or for hours. When of long duration it is followed by all the symptoms of imperfect aeration of the blood. In cases of secondary spasm, symptoms of primary disease may overshadow those of the larynx.

Treatment.—The treatment of spasm of the glottis in adults consists in treatment of the paroxysm, and, in the intervals, treatment of the associated disease. Unquestionably the remedy that gives most prompt relief is an inhalation of chloroform and hot water. Twenty to sixty drops of chloroform may be added to a pint of boiling water and the vapor inhaled. The first few breaths give relief, and it is rarely necessary to carry the inhalation to the extent of producing chloroform-anæsthesia. Nitro-glycerin internally, and nitrite of amyl by inhalation, usually give prompt relief. The smoking of stramonium leaves will be of benefit. A glass of spirits and hot water will often break up a mild attack. Belladonna or stramonium ointment applied over the larynx will be of service. Hot applications to the larynx are useful. A sponge or a piece of spongiopilin soaked in hot water is a convenient application. When the spasm is dependent upon an inflammatory condition of the larynx, hot flaxseed poultices over the larynx and the inhalation of compound tincture of benzoin with camphorated tincture of opium or tincture of stramonium will be beneficial.

In the intervals between the attacks, efforts must be made to remove the cause; if this is not possible, the use of remedies which diminish the nervous excitability will be indicated. As peripheral irritation exerts an immediate influence in provoking the attack, it is necessary that this should be allayed as far as possible. The iodide of potassium, tincture of belladonna, and tincture of lobelia, either alone or in combination, have proved useful agents in the writer's hands. Arsenic given in full doses has also been valuable. The bromides of sodium, ammonium, and potassium have a positive sedative influence in the nerve-excitability, and asafœtida and valerian find a fitting place in the treatment. In cases where malnutrition is present, varied tonic treatment, with nourishing food, proper clothing, and a mode of life based on sound hygienic principles, will be demanded.

DIPHTHERIA.

BY J. LEWIS SMITH, M.D.,

Clinical Professor of Diseases of Children, Bellevue Hospital Medical College, etc.,
New York.

IN order to treat a contagious disease properly, and at the same time to employ efficient measures to prevent its propagation to others, its etiology and pathology should be understood. We will therefore briefly describe the causes, modes of propagation, nature, and diagnosis of diphtheria before considering its prophylaxis and treatment.

The theory that true diphtheria is a microbic disease, and that the microbe which causes it is the Klebs-Loeffler bacillus, is now commonly accepted by bacteriologists and clinical observers. This microbe, discovered by Klebs in 1883, and subsequently more fully investigated by Loeffler and others, has nearly the same length as, but ordinarily more than double the thickness of, the tubercle-bacillus. Specimens of it, seen under the microscope, frequently present variations from the typical form, which are characteristic and of diagnostic value. Some of them present a granular appearance, and occasionally one has swollen extremities, so as to present a dumb-bell shape, or one extremity is swollen, so that the shape is like that of a pear or gourd. Occasionally one of the bacilli is curved like a bow. These characteristics, and the peculiar coloration by reagents, enable microscopists to distinguish the Klebs-Loeffler bacillus, the specific microbe of diphtheria, from other organisms. The researches, experiments, and statistics of a considerable number of bacteriologists and clinical observers might be adduced, such as those of Klebs, Loeffler, Roux and Yersin, Babes, Klein, Baumgarten, Sevestre, Jules Simon, and in this country Welch and Prudden, as sufficient to establish the theory that the Klebs-Loeffler bacillus is the causal agent in true diphtheria.

This bacillus, alighting upon the faucial, nasal, or other mucous surface, or the skin denuded of its epidermis, obtains there a nidus favorable for its development and propagation, but it does not enter the interior of the system except in rare instances pointed out by Roux and Yersin. It is not taken up by the lymph-ducts or blood-vessels and conveyed to the internal organs. It remains localized upon the surface, and produces there the characteristic inflammation. The microscopist finds it in abundance during the acute period of the inflammation in the pseudo-membrane and upon the underlying and surrounding inflamed surface. Acting solely upon

superficial parts, it cannot, therefore, in itself produce systemic infection or blood-poisoning, but, as the venomous reptile or the bee secretes a poison which it communicates by its fang or sting, the bacillus produces a peculiar poison which is readily taken up by the lymphatics and blood-vessels and conveyed to every part of the system. The systemic infection or blood-poisoning, from which so many of the victims of diphtheria perish, occurs from the absorption of this poisonous principle, secreted or elaborated by the Klebs Loeffler bacillus. L. Brieger and Karl Fraenkel¹ say that this poison consists of:

Carbon	45.35
Hydrogen	7.13
Nitrogen	16.33
Sulphur	1.39
Oxygen	29.80

They make the following statements in reference to it. It is destroyed by heat above 148° F. (60° C.), and is evaporated at 122° F. (50° C.). It is soluble in water, but insoluble in alcohol. It is not precipitated by ebullition, nor by the following agents: sulphate of sodium, nitric acid, and acetate of lead. But it is precipitated by concentrated carbolic acid, ferrocyanide of potassium, acetic acid, and nitrate of silver. Introduced into the circulation of rabbits and guinea-pigs, in the small quantity of two and one-half milligrammes to each kilogramme in the weight of the animal, it caused death. Sometimes the action of the poison is slow, death of the inoculated animal not occurring until the lapse of weeks or even months. When preserved in a vacuum, this poisonous product of the bacillus retains its virulence for months.

This poison, therefore, which renders diphtheria so fatal, is allied in its composition to the proteids or albuminoids, and recent bacteriologists have stated that it bears considerable resemblance to ichthyotoxicon, the poison secreted by sea-eels. One is reminded of Trousseau's remarks on diphtheritic paralysis published in 1868.² He quotes from Dr. Graves, of Dublin, the experiences of a ship's crew who ate a species of conger eel. Some of them died in violent delirium, and those who recovered were paralyzed three or four months. Trousseau adds, "Three or four months; mark well the duration, for it is absolutely the same as that of diphtheritic paralysis. . . . Well, then, diphtheritic paralysis belongs to the same category; its real cause is poisoning of the system by the morbid principle which generates the malady on which the paralysis depends." This sagacious observer perceived the resemblance between the poison secreted by the eel and that produced by the Klebs-Loeffler bacillus long before this micro-organism and the toxic principle generated by it were discovered.

Interesting and important investigations throwing light on the nature of the Klebs-Loeffler bacillus and its peculiar product have recently been

¹ Berliner Klinische Wochenschrift, November 17, 1890.

² Clinical Medicine.

made. Brieger and Fraenkel state that they were able to produce slight variations in the composition of the poison secreted by the bacillus which rendered it non-poisonous or benign. In attenuated cultures they produced an albuminoid which did not exhibit poisonous properties, and had the following composition :

Carbon	49.00
Hydrogen	7.00
Nitrogen	15.00
Sulphur	2.23
Oxygen	26.77

Roux and Yersin state that¹ their recent investigations confirm the belief that the bacillus itself is comparatively innocuous, but that the poisonous substance produced by the bacillus, and separated from it by filtration, inoculated in dogs and sheep, caused paralysis such as occurs in human diphtheria. Isolated from the bacillus by filtration and injected under the skin of rabbits and guinea-pigs, it was very fatal.

The same observers have made the remarkable and interesting discovery of a benign bacillus which is apparently identical, as regards its morphological characters, with the Klebs-Loeffler bacillus. They state² that they have found it not only in the mouths of healthy children in Paris, but in a distant village near the sea where diphtheria had not occurred within the memory of man. In this isolated locality they found it in the mouths of twenty-six out of fifty children. They believe that this benign organism is the Klebs-Loeffler bacillus deprived of its virulence, but they have been unable to produce its transformation into the genuine diphtheritic bacillus, or the reverse. They believe, however, that this transformation is possible, and that it does occur. It has been stated that this benign bacillus has been found in individuals recently cured of diphtheria. Perhaps foul air and insanitary conditions are agents by which the transformation of the mild into the pathogenic bacillus is accomplished.

Pseudo-Diphtheria.—It is an interesting fact in the history of diseases that two maladies that are entirely distinct, but whose symptoms and appearances are similar, have usually at first been regarded as identical. As time passed on, and they were more closely studied, their differences became more apparent, and they were finally regarded as distinct maladies and received different names. Thus, two centuries ago measles and scarlet fever were supposed to be the same, but during the present century the differences as regards their etiology, pathology, and nature have been fully recognized. There can be no doubt that the time is near when it will be seen that the term diphtheria has been applied to two distinct diseases, and we know no better names by which to designate the two than diphtheria and pseudo-diphtheria, the former produced by the Klebs-Loeffler bacillus and the poisonous product of this bacillus, and the latter produced by an-

¹ Annales de Gynécologie et d'Obstétrique, September, 1889.

² L'Union Médicale, March 14, 1891.

other microbe, or microbes,—to wit, the streptococcus and perhaps other forms of cocci. Moreover, if these micrococci produce a poisonous substance which enters the system and increases the severity and fatality of the disease, this substance is different from that produced by the Klebs-Loeffler bacillus, and its action in the system is in certain respects different. It is milder, and it much less frequently produces paralytic symptoms, and perhaps not at all.

Our knowledge of pseudo-diphtheria will doubtless soon be more full and accurate from the investigations which are being made, but sufficient is known to justify the following statements. The terms diphtheria and pseudo-diphtheria must be restricted to the diseases produced by microbial agency, and they cannot with any propriety be applied to the inflammation attended by fibrinous exudation produced by certain irritating non-microbial agents, as cantharides, chlorine, ammonia, boiling water, and steam.

In regard to pseudo-diphtheria the following facts are interesting and highly significant. Professor T. M. Prudden, of the New York College of Physicians and Surgeons, published in the *American Journal of the Medical Sciences* for May, 1889, an elaborate paper, detailing the microscopic examinations of the pseudo-membranes and tissues removed from twenty-four bodies of those who had died of supposed diphtheria. In no one of these specimens did he find the Klebs-Loeffler bacillus, but instead he discovered the streptococcus and staphylococcus. We must believe that the pseudo-membranous inflammation in these twenty-four cases was not produced by the agency of the Klebs-Loeffler bacillus, and that these twenty-four individuals did not die of true diphtheria, but of pseudo-diphtheria. Sevestre, of Paris, Wurtz and Bourges, Professor Hensch, of Berlin, and McWheaney, of the Royal Academy of Medicine, in Ireland, may be mentioned among those who believe that a pseudo-membranous inflammation sometimes results from the action of other microbes than the Klebs-Loeffler bacillus, and especially from the streptococcus.

Recently the doctrine that there are two forms of pseudo-membranous inflammation of microbial origin has received strong support from the observations of Baginsky, of Berlin. In a paper read before the Berlin Medical Society, and discussed by its president, Professor Virchow, as well as by Professor Hensch, Drs. Guttmann, Fraenkel, Ritter, and others, Professor Baginsky stated that he had made tube-cultures from the pseudo-membranes of all the cases admitted with the diagnosis of diphtheria into the Hospital for Sick Children during the past year.¹ He obtained a pure culture of the Klebs-Loeffler bacillus in one hundred and eighteen out of one hundred and fifty-four cases, and in most of these cultures the microbes associated with this bacillus disappeared during the cultivation, while the bacillus multiplied, was typical and easily recognized. In the remaining thirty-six cases cultivation yielded no bacillus, but only cocci, and thirty-

¹ Berliner Klinische Wochenschrift, Nos. 9 and 10, 1892.

two of the thirty-six recovered in a few days without any complication. Of the four who died, two had empyema, one pneumonia with measles, and the remaining one had a severe paralysis at the time of admission.

From these observations Baginsky also accepts the doctrine, and those who discussed his paper seem to have agreed with him in this matter, that there are two forms of pseudo-membranous inflammation of microbic origin, the one produced by the Klebs-Loeffler bacillus more severe and fatal than the other. This inflammation is, as we have seen, more liable to be followed by paralysis than the other and milder form of microbic inflammation. Thus, Baginsky, and apparently the distinguished Berlin pathologists and clinical observers who discussed his paper, recognize the doctrine enunciated above of two forms of microbic pseudo-membranous inflammation differing in severity and fatality. While he accepts the prevailing opinion that genuine diphtheria is caused by the Klebs-Loeffler bacillus, he states that the milder microbic pseudo-membranous inflammation is caused by streptococci and staphylococci. Baginsky also states that these two forms of pseudo-membranous inflammation of microbic origin are indistinguishable in their gross characters, and that both are accompanied by fever, prostration, and tumefaction of the lymphatic glands.

In considering the theory of the duality of the microbic inflammations to which the term diphtheria has been applied, it is proper to state that at the discussion of Professor Baginsky's paper the dissentient opinion was expressed that possibly in those cases in which the Klebs-Loeffler bacillus did not occur in the pseudo-membrane, but streptococci and other cocci were observed, the former may have been present and caused the inflammation in the beginning of the attack, and disappeared in the progress of the disease, being "replaced by other microbes,"—an improbable supposition. Whatever the truth in reference to this matter, it is certain from the concurrent opinion of bacteriologists and clinical observers in all countries that this prevalent and fatal microbic inflammation, which in some places sensibly retards the increase of population, is in a large majority of cases caused by the Klebs-Loeffler bacillus. But we should not overlook the fact, as certain French physicians have pointed out, that in genuine diphtheria in which the Klebs-Loeffler bacillus is the efficient causal agent other micro-organisms, particularly the streptococcus and the staphylococcus, are often found associated with it in the pseudo-membrane and upon the adjacent inflamed surface. Moreover, these cocci occur in internal organs not reached by the Klebs-Loeffler bacillus. They have been found in the glands, kidneys, and lungs, and in abscesses of the neck in the angina of diphtheria. These micrococci, therefore, probably propagated from the surface, may be found in future investigations to exert some pathogenic action, even in cases of true diphtheria, in which the Klebs-Loeffler bacillus is the chief morbid agent.¹

¹ Medical Age, April 10, 1891.

Vitality of the Klebs-Loeffler Bacillus.—Many instances are related in the literature of diphtheria showing the remarkable vitality of this bacillus. D'Espine and E. de Mariqual state that cultures of it kept sixteen months have retained their primary virulence.¹ Sevestre cites instances in which the contagious principle of diphtheria, after being latent for long periods, communicated the disease. Thus, a girl, in a locality where there was no diphtheria, examined the clothes worn by her mother, who had died of this malady two years previously, the clothes having been in a chest during this time. After about the usual incubative period she was attacked with diphtheria. A brush used for swabbing the throat of a child having diphtheria was wrapped in paper and laid aside. Four years subsequently a man having simple sore throat made an application to it with the brush, and his fauces soon after became the seat of a diphtheritic exudate. A severe and fatal epidemic of diphtheria occurred in a Norman village. Twenty-three years had elapsed, and no recent case of diphtheria had occurred in or near the place, when excavations were made in the grave-yard, and the bodies of those who had died of diphtheria nearly a quarter of a century previously were exhumed. The grave-digger's son, who collected the bones of the victims of diphtheria and piled them together, was immediately afterwards attacked with diphtheria. He was the first patient in the epidemic which followed. Other cases might be related, showing the remarkable vitality of the Klebs-Loeffler bacillus, which may remain latent not only for months but for years and subsequently become active under favorable circumstances. This is an important fact, and one that should be fully recognized in the employment of measures to prevent the propagation of diphtheria. In my opinion, based on observations during many years in New York City, with its large floating population and crowded tenement houses, instances are not infrequent in which apartments are infected for years, so that successive occupants contract the disease.

Age.—The published statistics relating to the ages of diphtheritic patients evidently embrace all cases of pseudo-membranous microbic inflammation, whether the cause be the Klebs-Loeffler bacillus or a micrococcus,—in other words, whether the disease be diphtheria or pseudo-diphtheria. Trousseau has said that diphtheria does not spare any age, but is most common between the ages of two and five or six years. Guersant believes that the age of greatest frequency is between the second and seventh years, and Barthez and Rilliet agree with him. Bouillon-Lagrange, in seventy-three cases occurring in one epidemic, treated

Under 2 years	14 cases.	From 18 to 30 years	15 cases.
From 2 to 6 years	18 "	" 30 to 40 "	4 "
" 6 to 12 "	10 "	" 40 to 50 "	1 case.
" 12 to 18 "	9 "	Above 50 "	2 cases.

According to M. Barthez, in Sainte-Eugénie Hospital during twenty years

¹ *Revue Médicale de la Suisse Romande*, Geneva, 1890.

the ages of the diphtheritic patients were as follows, adults being excluded from this institution :

Under 1 year	81 cases.	From 6 to 7 years	59 cases.
From 1 to 2 years	314 "	" 7 to 8 "	36 "
" 2 to 3 "	319 "	" 8 to 9 "	24 "
" 3 to 4 "	292 "	" 9 to 15 "	82 "
" 4 to 5 "	200 "	" 15 to 17 "	2 "
" 5 to 6 "	103 "		

Louis has shown that diphtheria may occur at an advanced age, but that it is infrequent after the age of forty years, and rare after sixty years.

As in scarlet fever, so in diphtheria, cases are infrequent under the age of six months. Oertel says, "In the first half-year the infant organism seems to be not at all susceptible to the disease." Nevertheless, cases are on record showing that it does occur even in the newly-born. Dr. Abraham Jacobi says, "I have met with three cases of diphtheria of the pharynx and larynx in the newly-born myself. One of these became sick on the ninth day after birth, and died on the thirteenth day; the other died on the sixteenth day after birth; the third was taken when seven days old, and died on the ninth day."¹ He has collated the following cases: one of fourteen days treated by Tigri, one of fifteen days by Bretonneau, one of seventeen days by Bednar, one of eight days by Bouchut, one of seven days by Weikert, several cases by Parrot, and eighteen cases observed by Sirédey.

A disease of the newly-born has occasionally been observed in maternity wards which seems to be of diphtheritic origin, but which presents unusual features. Thus, Dr. W. S. Bigelow reports, in the *Boston Medical and Surgical Journal* for March 11, 1875, ten cases occurring, in the latter part of 1873, in the Boston Lying-in Asylum, all fatal but two. The prominent symptoms and anatomical characters were, a dark hue of the skin, hæmaturia, pseudo-membranous exudation upon certain mucous surfaces, dark-green stools, spleen enlarged and dark, kidneys engorged; in some of the cases effusion of blood into the pelves of the kidneys and along the urinary tract. Dr. Bigelow refers to what appear to have been similar cases in one of the European asylums. The belief that this disease was one of the manifestations of diphtheria was based on the facts of its apparent contagiousness, and the presence of blood-cells, albumin, and renal casts in the urine. The fact that so far as appears from the records the mothers remained well, does not preclude this belief, for in cases of microbic pseudo-membranous inflammation occurring in the newly-born in the New York Infant Asylum, to which we shall presently refer, the mothers, with one exception, remained well.

A case in some respects similar to those observed by Dr. Bigelow came under my notice. Malignant diphtheria occurred in a family in West

¹ Treatise on Diphtheria, Wood & Co., New York, 1880.

Fifty-Third Street, New York, in October, 1880. The patient, a boy of ten years, died, and the remaining two children, as soon as the nature of the malady was apparent, were sent from the house. Nevertheless, one of them, seven days after the removal, was attacked with diphtheria, of the hemorrhagic form, and died in less than one week. Blood escaped from the nostrils, from the fauces, from the vessels under the skin in numerous places, causing hemorrhagic spots, and from the kidneys, or urinary tract, causing hæmaturia. The mother suffered great mental depression, although her general health seemed good. Her infant, born three months subsequently to the occurrence of diphtheria in her family (February 6, 1881), was well developed, but it presented a similar hemorrhagic cachexia to that in the second case of diphtheria. Blood escaped from the vessels under the skin, causing blotches and prominences, and from the mucous surfaces. The bleeding was persistent and copious from the umbilicus, so that death occurred in less than a week. The poison elaborated by microbes is subtle and penetrating, causing the specific inflammation in the uterine walls of the parturient woman, even when her fauces are not affected, but the exact causal relation of diphtheria, or pseudo-diphtheria, to cases like the above must be determined by future observations.

The admitted infrequency of diphtheria in the newly-born, and the statement made by certain writers that they possess entire immunity from it, induced me to publish elsewhere the history of an epidemic occurring in the maternity service of the New York Infant Asylum. In December, 1887, and in the commencement of 1888, five of the newly-born, aged respectively seven, seven, nine, seventeen, and thirty-seven days, had pseudo-membranous inflammations occurring upon the mucous surfaces usually affected, and only one recovered. In one of them the pseudo-membrane occurred upon both sides of the fauces, both surfaces of the epiglottis, and upon the laryngeal surface, completely concealing the vocal cords and the portion of the larynx above them. The lungs were thickly mottled with points of extravasated blood. From the specimens removed from this case Professor Prudden obtained and cultivated the streptococcus and staphylococcus. In another of the five cases death occurred at the age of ten days, the fifth day of an umbilical phlegmon, and the third day of the pellicular inflammation upon the fauces. Professor Prudden, who conducted the autopsy and made microscopic examinations, wrote as follows of this case: "The anatomical diagnosis, then, is diphtheria of the pharynx, larynx, and trachea, with double broncho-pneumonia, localized septic inflammation of the umbilical vein and hypogastric arteries, and the abdominal wall surrounding them." In the third case the pseudo-membrane occurred upon the nasal, faucial, laryngeal, tracheal, and œsophageal surfaces; in the fourth case, the symptoms indicated the presence of acute nasal catarrh, but the only visible pseudo-membrane was upon the tonsils, from which it could not be removed by the brush; in the fifth case, which resulted favorably, the nostrils seemed to be unaffected, but the

grayish-white diphtheritic exudate appeared upon the posterior surface of the fauces. By antiseptic and solvent inhalations this gradually became smaller, and on the fourth day of the sickness, at the age of twenty-one days, it had disappeared.

This epidemic in the Infant Asylum, so far as could be ascertained by the cultures and investigations in the laboratory of the College of Physicians and Surgeons, was produced not by the agency of the Klebs-Loeffler bacillus, but by the streptococcus. According to our nomenclature, then, the disease was not a genuine diphtheria, but a pseudo-diphtheria.

Incubative Period.—This in animals inoculated with diphtheritic material is from twelve hours to three days. In Trendelenberg's experiments the incubative period was mostly from one to three days; in Lagrave's, about twenty hours. In Duchamp's inoculations the animals died after forty-eight hours, with the larynx and trachea, upon which the infectious material was applied, covered with pseudo-membrane. Oertel says that the rabbits upon which he experimented by inoculation of the muscles perished in from thirty to thirty-six hours, rarely after forty-two hours, the disease-process extending rapidly to neighboring tissues. When diphtheria is contracted by a child upon a wounded or excoriated surface, as after circumcision, or ablation of a tonsil, or upon a leech-bite or a burn, the incubative period is short, but it may be as long as four days. Thus, the *British Medical Journal*, and subsequently the *Archives of Pediatrics*, published the following interesting case, contributed by Mr. Phillips. A few hours after the performance of tracheotomy for diphtheritic croup, the same instruments were employed for performing circumcision in a child of eighteen months. Four days later a false membrane appeared upon the wound of the prepuce, which by the following day had extended over the glans, with much œdema of the prepuce, and retention of urine.

When diphtheria is contracted in the usual manner,—that is, by the inspiration of air containing the specific principle,—the period of incubation appears to be on the average somewhat longer than when it is communicated by direct contact. My observations lead me to believe that when the incubative period is short the disease is likely to be severe, and mild when the incubative period is long. I was enabled to ascertain very nearly the incubative period in the following cases. A boy of nine years was in the same room about one hour on Saturday with a child who had fatal diphtheria. On the following Tuesday, without any other exposure, he sickened with a fatal form of the malady. Mrs. E. assisted in nursing a severe case of diphtheria from November 11 to 13, 1874, after which she returned home, several blocks away. On the evening of the 15th she complained of sore throat, and on the following day the diphtheritic pseudo-membrane was observed upon her tonsils. On the 19th the exudation had disappeared, and she was convalescent. On the 20th her sister, who resided with her, and who had not been elsewhere exposed, was also attacked. The only other case in the family, a boy, sickened with diphtheria on December 2. In the

first of these cases the incubative period seems to have been from two to four days, while in the last it was longer. In April, 1876, a girl died of malignant diphtheria in West Forty-First Street, New York. Her sister, aged one year, remained with her from April 14 to 17, when she was removed to a distant part of the city and placed in a family where there had been no diphtheria. On April 24, seven days after her removal, this infant was observed to be feverish, and on the following day, when I was called to examine her, the characteristic diphtheritic patch had begun to form over the left tonsil. In April, 1875, two sisters, aged five and seven years, resided with their parents in a boarding-house in West Twenty-Second Street. A playmate in the same house had symptoms which were supposed to be due to a cold, but which were diphtheritic, when one night severe laryngitis occurred, and ended fatally the following day. The physician who had been summoned diagnosticated diphtheria, and the two sisters were immediately removed to a hotel. Seven days subsequently, diphtheria commenced in the older child. The younger sister was then removed to a distant part of the same hotel, but six or seven days later she also was attacked. Sanné says that in ninety-eight cases the incubative period, so far as could be ascertained, was as follows:

From 1 to 2 days	7 cases.
" 2 to 8 "	48 "
" 8 to 13 "	23 "
" 13 to 15 "	6 "
" 15 to 20 "	14 "

But diphtheria is so insidious, and the modes of exposure are so many, that in some of the cases of an apparently long incubation there may have been a second exposure. The above statistics show that the incubative period varies, but is most frequently from two to eight days.

MODES OF PROPAGATION.

No fact is better established than that diphtheria does not originate *de novo*, whatever may be the insanitary conditions. It is produced by the reception in or upon some part of the system of the pre-existing specific germ. Its extreme contagiousness from person to person is well known. A moment's exposure to the breath of a patient, or in the infected room where he is under treatment, or has been, perhaps, weeks or months previously, has in numberless instances communicated the disease. The virus adheres tenaciously to objects on which it happens to alight. The clothing of a patient, even when the disease is in its mildest form, his bedding, the furniture of his room, and the objects which he handles, may for weeks afterwards communicate the disease, even when transported to a distance. A child with malignant diphtheria seen by me in consultation apparently contracted it by embracing a school-mate who was in the street for the first time after an attack of diphtheria. In another instance a child was

for a brief period in a room where diphtheria had occurred two months previously, and after the usual incubative period sickened with the disease. The diphtheritic poison may remain in an active state for months between the leaves of a book handled by a patient having a mild attack or during convalescence. As might be supposed from its subtle nature, diphtheria is sometimes unwittingly or carelessly communicated by third persons who remain unaffected. We will relate a striking case in our remarks on the prophylaxis.

Although diphtheria is often contracted in the manner mentioned above,—that is, by exposure to a diphtheritic patient or to a room or some object infected by such patient,—there is another mode of infection common in the cities. Dr. Sternberg in his recent Lomb Prize Essay, published by the American Public Health Association, refers to the fact that damp, foul places, such as sewers, cellars, and ill-ventilated spaces under floors where the sunlight never enters and where refuse collects, afford conditions favorable for the development and propagation of the diphtheritic germs. The specific germs of diphtheria, once received, may be propagated in such a place for an indefinite time, and, ascending in the vapors which arise from this culture-bed, are liable to communicate the disease to any one who is exposed to them. Thus, in New York City prior to 1850, although foul sewers and insanitary conditions existed, there was no diphtheria, but in the decade following 1850 diphtheria was introduced. Its specific germs made their way into the sewers underground; and now wherever sewer-gas escapes into the domiciles of this city it carries with it the diphtheritic virus. The amazing vitality and power of propagation of the diphtheritic microbes are apparent when we reflect that they permanently infect the filthy but constantly-flowing and constantly-renewed currents of the sewers of a great city. In all the wards, and apparently in every street, in New York City, children are constantly falling sick with this disease, contracted by inhaling sewer-gas, which notwithstanding “sanitary plumbing” often escapes from unsuspected sources, even in houses constructed with all the modern improvements. That the disease is so prevalent is to a great extent due to exposure of children to infected sewer-gas which ascends from this widely extending underground culture-bed, and to walking cases, often so mild that there is little or no complaint of the throat or impairment of the general health. Most of the contagious diseases of children are quickly detected by characteristic symptoms or appearances, with which the most ignorant families are to a certain extent familiar; but mild diphtheria possesses so few subjective symptoms that it is often not suspected or detected even in intelligent families who are watchful of their children. Children with mild diphtheria sit among other children in the schools, in the city conveyances, in the churches and dispensaries, and frequently communicate to those who are near them a malignant form of the disease, from which the unfortunate victims quickly perish. The diphtheritic microbes are so subtle, and their vitality and power of propagation so great,

that when they have entered the sewers of a large city which furnish the conditions of a culture-bed, so that the sewer-gas wherever it escapes is liable to communicate diphtheria, it is very difficult, perhaps impossible, to eradicate this disease by measures, however stringent and appropriate, employed by Health Boards, even though aided by the active and intelligent co-operation of families.

Commonly, as we have said, diphtheria is communicated by the inhalation of infected air, the inhalation of air containing the specific principle, whether derived directly from a patient or from some infected inanimate object, as the walls of a room, furniture, apparel, an article of merchandise, or sewer-gas. More rarely diphtheria is communicated by direct contact with some infected solid substance, as a particle of the diphtheritic exudate, muco-purulent secretion from an infected surface, or the blood of a patient. In a considerable number of instances recorded in the literature of diphtheria, over-anxious and self-sacrificing young surgeons have sucked the obstruction from the tracheotomy-tube in cases of diphtheritic croup with perhaps relief to the patients, but with the occurrence of fatal diphtheria in themselves from the exposure. A diphtheritic conjunctivitis, severe, and dangerous to the eye, has sometimes occurred in the attending physician or nurse after examination of the fauces of the diphtheritic patient, produced probably by a particle of pseudo-membrane or muco-pus thrown into the eye by the expulsive cough. In these instances of communication by direct contact the poison is received either upon one of the mucous surfaces or upon the skin denuded of its protecting epidermis.

Diphtheria contracted from Animals.—Observations are accumulating which show that diphtheria occurs in certain domestic animals and is sometimes communicated from them to man. That certain animals are liable to it has been shown by inoculations in many laboratories, made for experimental purposes. The feathered tribe especially appear to be susceptible to this disease. On the island of Skiathos, off the northeastern coast of Greece, no diphtheria had occurred during at least thirty years previously to 1884, according to Dr. Bild, the medical practitioner of the island. In that year a dozen turkeys were introduced from Salonica. Two of them were sick at the time, and died soon afterwards; the others became affected subsequently, and of the whole number seven died, three recovered, and two were sick at the time of the inquiry. These two had laryngeal obstruction, with difficult breathing, and swelling of the glands of the neck. As further evidence that the disease was true diphtheria, one of the turkeys that survived had paralysis of the feet. The turkeys were in a garden on the north side of the town, and the prevailing winds on the island are from the north. When this sickness was occurring among the turkeys, an epidemic of diphtheria commenced in the houses nearest to the garden, and spread through the town. It lasted five months, and of one hundred and twenty-five cases in a population of four thousand, thirty-six died. Diphtheria was from this time established upon the island, and frequent

epidemics of it have occurred since.¹ M. Menzies² states that diphtheria is common among the poultry in Italy, in which country the flat roofs of the houses afford a resting-place for turkeys, fowls, pigeons, and rabbits, and their evacuations are carried by the rain into the cisterns and wells. A physician at Posilippo, near Naples, had directed his servant not to obtain drinking-water from the well next to his house, but from a well at a distance. So long as he obeyed the instruction his family was well; but, yielding to his indolence, he finally disobeyed the command, and obtained water from the infected well. Four of the children who drank this water soon took diphtheria and died. The fifth child, who did not drink the water, escaped. In 1878-79 Nicati, of Marseilles, observed cases in which diphtheria was apparently contracted from fowls.³ Dr. F. T. Wheeler⁴ states that while in a nesting of wild pigeons he found many sick with a pseudo-membranous sore throat. He dissected many with his pocket-knife, which he was obliged to throw away on account of the offensive odor. There were millions of pigeons in the nesting, and they were hunted and eaten by the inhabitants. The same year diphtheria broke out in a most malignant form among the people, causing the death of many children. Several years previously pigeons nested in the same locality or near by, and fully half of the children in the vicinity had diphtheria. Dr. George Turner⁵ states that a pigeon was brought to him for dissection. The whole of its windpipe was covered by a pseudo-membrane, as in the croup of a child. Pigeons were inoculated in the fauces with this membrane, and a similar disease was produced, which extended to their eyes through the nostrils. An epidemic of diphtheria occurred in the village of Braughing, Hertfordshire, England, the first cases appearing upon a farm where the fowls were dying of a disease similar to that in the pigeons; and on other farms where diphtheria appeared it was preceded by a similar disease in the fowls. Dr. Turner also relates several other epidemics of diphtheria in different localities accompanied by a fatal pseudo-membranous inflammation in the feathered tribe, the poultry, turkeys, pigeons, and in one locality the pheasants. At Tougham a man bought a chicken at a low price, as it was affected by the prevailing disease, and cared for it at his home. Soon after diphtheria broke out in his family, and this case was the first in the village. Bilhaut⁶ states that a pigeon-fancier had lost several birds by disease. He endeavored to save one of them that was sick by allowing it to pick food from his tongue. The pigeon died, and an examination showed that it died from diphtheria. Before its death the man sickened with diphtheria, and pseudo-membranes formed underneath his tongue on either side

¹ Bulletin Médical, January 22, 1888.

² Thesis, Paris, 1881.

³ Marseille Médical, 1879, p. 105.

⁴ American Practitioner and News.

⁵ Journal of Laryngology and Rhinology.

⁶ Journal de Médecine de Paris, July 13, 1890.

of the frænum, where the bird had picked its food, and also upon his tonsils. Recently M. Cagny also has related cases showing the propagation of diphtheria from the feathered tribe to man.¹ Roux and Yersin and some other bacteriologists have stated that the microbe in avine diphtheria differs from that in man, but it may change somewhat in form in passing from one animal to another, just as small-pox is modified in the cow. Certainly observations show that cases of avine and of human diphtheria sustain an intimate relation to each other sufficient to prove their essential identity.

Diphtheria contracted from Quadrupeds.—Bacteriologists in their experiments have demonstrated the fact that certain quadrupeds used for experimental purposes contract diphtheria. Trendelenberg inoculated sixty-eight rabbits, introducing diphtheritic pseudo-membrane through an artificial opening. Eleven of the rabbits died with the symptoms and appearances of diphtheria. In control experiments he introduced various foreign bodies into the larynx of rabbits, and was unable to produce results or lesions resembling those in diphtheria. Oertel performed twelve similar experiments, and five of the rabbits died after the production of pseudo-membranes. Zahn, Gerhardt, Labadie-Lagrave, Francotte, Bates, Klein, and Vulpian may be mentioned among those who have obtained similar results from their inoculations. Bruce Low in his report to the local government board² states that a little boy at Enfield had fatal diphtheria and vomited on the first day of his illness. A cat licked the vomited matter from the floor, and soon after the boy's death it was noticed to be ill, and its suffering and symptoms so closely resembled those of the dead boy that it was destroyed by the owner. During the first part of its sickness the animal was allowed to go out in the back yard, and a few days subsequently the cat of a near neighbor became ill. This cat had frequented the back yard. It was nursed during its sickness by three little girls, all of whom took diphtheria. Lawrence³ reports two cases in which diphtheria seems to have been communicated by cats. In the first case, that of a little girl, a careful inquiry showed that the child had not been exposed to any case, although diphtheria was prevailing within a mile of the patient's residence, but she had fondled a sick cat a few days before. The cat died some days afterwards, and a second cat became sick and was killed. Inquiry disclosed the fact that a neighboring farmer had lost seventeen cats, and another fifteen cats, from a throat distemper, and one of the farmers stated that he had examined the throats of some of the cats and found them covered with a white membrane. S. C. Coleman, of Colorado, Texas, states⁴ that after a residence of five years in Colorado he saw the first case of diphtheria. A child of five years, living thirty miles distant in the country, with no neighbor within six miles, had diphtheria followed by paralysis. Being

¹ Journal de Médecine, July, 1890.

² British Medical Journal, May 10, 1890.

³ Medical Press and Circular, London, June 4, 1890.

⁴ New York Medical Record, November, 1890.

far from any source of human contagion, this child had rarely seen other children. The father stated that two kittens had recently died of what seemed to be the same disease as that of the child, who had nursed them and frequently kissed them. Coleman does not doubt that the diphtheria was contracted from them. George Turner and A. Jacobi also relate cases showing that diphtheria in the quadruped may be communicated to children, and *vice versa*. The risk in fondling diseased cats which may happen to be the pets of the nursery cannot be too strongly stated.

Many observations have shown, during the last few years, that milk affords a favorable nidus for the propagation of the Klebs-Loeffler bacillus, and that occasionally epidemics are produced by an infected milk-supply. In 1879, Mr. W. H. Power, Health Inspector, investigated an outbreak of diphtheria, and believed that he traced it to the milk. The cows that furnished the milk that apparently caused the diphtheria had what the veterinary surgeons designate "garget," or "infectious mammitis." Gooch has described an outbreak of diphtheritic tonsillitis in Eton College which was traced to the milk employed. The cows furnishing the milk drank water which contained sewage from a neighboring farm. The investigation showed that the milk when boiled was harmless, since the boiling destroyed the germs, but when used unboiled the disease was communicated. The cows were removed to another pasturage, where the water used by them was different, and the epidemic ceased. The disease was in all instances propagated by the milk-supply. Observations, therefore, show that milk, which is a culture-medium of various microbes, is sometimes the medium of communication of diphtheria, as it is known to be of scarlet fever.

DIAGNOSIS.

No more important duty devolves upon the physician than that of making an early and correct diagnosis of diphtheria, and of those maladies of the throat which resemble diphtheria in appearance, but are in their nature distinct from it. If the case be one of diphtheria it should be known at the beginning, so that proper remedial measures may be employed as well as measures designed to prevent propagation. If the disease be not diphtheria, a correct diagnosis is required so that needless treatment and alarm may be prevented. In many cases the diagnosis is easy after diphtheria has continued twenty-four hours, since, in addition to the fever and pain in swallowing, the characteristic grayish-white pellicle has begun to form on one or both tonsils. If the exudate be not limited to the tonsils, but extend to the fauces and cover more or less the pillars and arch of the palate and the uvula, the disease is diphtheria. Under such circumstances the nature of the malady is apparent on inspecting the fauces. But many cases are not so quickly and readily diagnosticated, even by experienced physicians. The diagnosis is uncertain, and is postponed until one or more days have elapsed. One reason of failure to diagnosticate early is the fact that many patients, even those old enough to express their sensations, do not

complain of the throat. I have many times been informed by parents and nurses that there was no need of examining the fauces, as there was no complaint of pain in the throat, and yet on examination have observed unequivocal evidence of diphtheria. A physician practising in a locality where diphtheria prevails should always at his first visit inspect the fauces of a child to whom he is summoned, especially if there be fever, even if there be no manifest symptoms pertaining to the throat, and he will not infrequently discover evidences of diphtheria which, without such examination, would not have been detected.

When diphtheria has continued from twelve to twenty-four hours, external examination of the neck usually reveals some tenderness as well as fulness in the tonsillar regions, and enlargement of the tonsils can be readily discovered on palpation, but in some instances the tenderness and swelling are so slight as to be scarcely appreciable. In not a few instances it was impossible, prior to the discovery of the Klebs-Loeffler bacillus, to make a diagnosis until the disease had been under observation some days and its progress and character had been carefully noted, the difficulty in diagnosis arising from the fact that the pseudo-membrane was concealed from view. Thus, in nasal diphtheria the pseudo-membrane may be located upon the superior and posterior portions of the Schneiderian membrane, and therefore be invisible, while the anterior and visible portions of the nares and the faucial surface are hyperæmic and secreting muco-pus in abundance, but are free from the pseudo-membranous exudate. The pseudo-membrane may, and probably will, appear upon visible parts before the disease terminates, but not early enough to establish a diagnosis in the first days of the sickness. Occasionally in the milder forms of pharyngeal diphtheria membranous patches occur in the depressions of the faucial surface, and are not visible on cursory inspection. They are brought into view when the patient coughs, or by firm external pressure upon the side of the neck which elevates the depressed surfaces.

In laryngo-tracheal diphtheria diagnosis is not infrequently delayed in a similar manner. The child without known exposure to the diphtheritic virus becomes hoarse, and the hoarseness with fever increases. The fauces show the characteristics of catarrhal inflammation, and the nostrils are not affected or are affected but slightly. The diagnosis between catarrhal croup, non-specific membranous croup, and diphtheritic croup is uncertain. The patient may die without any visible pseudo-membrane, unless the laryngoscope be used, and without a diagnosis except the general one of croup. The occurrence of albuminuria with casts may enable us to make the probable diagnosis of diphtheria, and this opinion may be confirmed by the contemporaneous or subsequent occurrence of diphtheria in other members of the family; but in other instances no such aid is obtained, and the nature of the attack continues to be a matter of probability only, unless some other aid to diagnosis be employed. Such are some of the hinderances in the way of accurate diagnosis.

Fortunately, the discovery of the Klebs-Loeffler bacillus and the experimental and clinical proof that it is the cause of true diphtheria enable the physician to make an early and clear diagnosis. If the nature of the disease be doubtful, particles of muco-pus or pseudo-membrane removed from the inflamed surface should be examined under the microscope, and if the Klebs-Loeffler bacillus, described in a preceding page, be discovered, the diagnosis of diphtheria is certain. On the other hand, if one or, better, two or three careful microscopic examinations be made, and this bacillus be absent from the specimens, the announcement may be made with assurance that the disease is not true diphtheria. The importance as a means of diagnosis of the presence or absence of the Klebs-Loeffler bacillus is now being fully recognized by prominent physicians in the medical centres of Europe where diphtheria prevails, as in Berlin and Paris. It is well known that the pseudo-membrane is not an initial lesion in diphtheria. Some hours, during which the inflamed surface presents the anatomical characters of a catarrhal inflammation, elapse before the pseudo-membrane appears. My observations lead me to believe that occasionally this inflammation abates after continuing one or more days without any pseudo-membranous formation. The late Dr. George B. Wood stated that he seldom attended a case of scarlet fever without suffering from sore throat. In like manner I think that those who are closely exposed to diphtheria sometimes have a sore throat which does not pass beyond the stage of a catarrhal inflammation, but as it is caused by the specific virus it should, of course, be designated diphtheritic. I see no way of clearly and certainly diagnosing this inflammation from non-specific catarrhal inflammation except by examination for the Klebs-Loeffler bacillus.

But a microscopic examination cannot be made in the sick-room. Delay and leisure are required for this purpose, while it is very important that a diagnosis, at least probable, be made at the first visit. We shall therefore briefly state the characters of diphtheritic inflammation, and of other inflammations which resemble it but are distinct from it.

DIPHTHERITIC INFLAMMATION.

The diphtheritic exudate upon the faucial, buccal, and nasal surfaces is deeply set in the mucous membrane, penetrating it and being incorporated with it. It consists of necrosed mucous tissue and firm fibrinous material exuded from the minute vessels. It cannot be detached, except at an advanced stage of the disease, without causing hemorrhage. It is surrounded by inflamed and swollen mucous membrane, as the crystal of a watch is surrounded by the rim. The pellicle causes superficial or deep necrosis of the mucous membrane, and is attended by the secretion of muco-pus, sometimes tinged by the presence of red blood-cells. Let us compare these characters of diphtheritic inflammation with those of other and distinct diseases from which it is very important that diphtheria should be differentiated in practice.

Pseudo-Diphtheria, or Diphtheroid.—This has long been confounded with true diphtheria, and has only recently been differentiated from it, chiefly through the microscopic examinations and cultures made by Drs. Prudden and Park in America, and Roux, Yersin, Martin, and Baginsky in Europe. Pseudo-diphtheria is produced by the streptococcus and perhaps other forms of cocci. The streptococcus does not generate so deadly a poison as that of the Klebs-Loeffler bacillus, and perhaps no toxine at all. Consequently the systemic infection in true diphtheria is different from that in pseudo-diphtheria, and much more fatal. Nevertheless, while the Klebs-Loeffler bacillus does not enter the system, the cocci do, and there is frequently a mixed infection in cases of true diphtheria, the streptococcus and other forms of cocci being present with the Klebs-Loeffler bacillus.

In pseudo-diphtheria a pellicular exudation occurs, presenting the morphological and anatomical characters of that in true diphtheria, but, since the very powerful and active poison of the latter is absent, the mortality in pseudo-diphtheria is much less than that in true diphtheria. There is every reason to believe that pseudo-diphtheria long antedated true diphtheria in this country, having been present and causing the so-called membranous croup in the first half of the present century and perhaps in the last century. Pseudo-diphtheria is contagious, and requires the same treatment as true diphtheria, but it is obviously distinct from it—as typhoid is from typhus fever.

Follicular Pharyngitis or Tonsillitis.—This is a common disease, most likely, it seems to me, of microbic origin. In New York, and probably elsewhere, it frequently extends through families as if contagious, all or most of the children being affected by it. It is attended by fever and dysphagia. It has no marked premonitory symptoms, unless of very brief duration, and commences suddenly, like diphtheria, with headache, chilliness, heat of surface, the temperature often rising to 103° F., languor, and frequently pain in the back and extremities. The dysphagia attracts attention to the fauces, the surface of which is seen to be hyperæmic, especially its tonsillar portion. In a few hours a whitish material exudes from the crypts of the tonsils, consisting of the secretion of the crypts and epithelial cells, and forming rounded masses of the size of a small pin's head. This secretion, occurring as small, rounded, salient masses, distinct from one another, is distinguished by its appearance from the diphtheritic pseudo-membrane, which at first is a thin, pellucid film, becoming thicker subsequently. Consisting simply of epithelial cells, held together by the secretion, these small rounded masses are quickly detached by the swab or brush, when they are found to be friable, readily crushed between the thumb and fingers, and having a fetid odor. If two or more of them happen to unite, forming an appearance like that of the diphtheritic membrane, they still present the same physical characters, and are readily detached from the tonsillar surface without hemorrhage. This peculiar secre-

tion of follicular tonsillitis is usually limited to the tonsillar portion of the pharynx, and is of short duration, no new secretion occurring after two or three days. The inflammation soon abates. In a large number of cases which I have observed, the clinical history of this disease has been as mentioned above, except in one instance, when death occurred apparently from a sudden extension of the inflammation to the larynx and the occurrence of œdema glottidis. The diagnosis of follicular pharyngitis from diphtheria is easily made, except occasionally as regards the mildest form of diphtheria.

Pultaceous Pharyngitis, Confluent Mucet.—This form of pharyngitis occurs in low or debilitated states of the system. It occurs in protracted and exhausting diseases attended by malnutrition and faulty digestion. As the term “pultaceous” indicates, the inflammatory product is soft and friable, coming away in fragments when touched by the brush or sponge, without bleeding or injury to the mucous membrane. Under the microscope it is found to consist of epithelial cells, often in fragments, nuclei, and nucleoli, but no fibrin. In certain cases to which the term cryptogamic is properly applied, a cryptogam, the *oïdium albicans*, is also present. When the substance forming this soft and pultaceous pellicle is removed, the mucous membrane underneath is entire, hyperæmic, and sometimes covered with a newly-formed epithelial layer. The appearance of the pultaceous product to the naked eye may closely resemble that in diphtheria, but its friable character, its epithelial nature, and the absence of fibrin, which the microscope reveals, render the diagnosis certain. In the New York Foundling Asylum, at a time when diphtheria was prevailing, the tonsils of a newly-born infant were covered with a grayish-white pellicle believed to be diphtheritic, although the rarity of diphtheria in the newly-born is well known. After its death the curator, Dr. Northrup, discovered a layer of soft, pultaceous material over the tonsils, but no fibrin or diphtheritic exudate. The disease was that which we are describing.

Scarlatinous Pharyngitis, Gangrenous Pharyngitis of Scarlet Fever, or Scarlatinous Pharyngitis with Necrosis.—The frequency of scarlet fever and diphtheria, and the facts that epidemics of the two are not uncommon at the same time, and that diphtheria often attacks a scarlatinous patient, render important the differentiation of scarlatinous pharyngitis from diphtheritic pharyngitis. Especially is it important to determine whether the grayish-white pellicle which so often appears upon the faucial surface during an attack of scarlet fever be due to the local action of the scarlatinous poison or to the supervention of diphtheria. Frequently when the pharyngitis of scarlet fever is severe, an abundant desquamation of epithelial cells occurs, which, aggregating, produce the pultaceous covering described above, which in its gross appearance so closely resembles the diphtheritic exudate. We need not mention again the anatomical characters which enable us to make a differential diagnosis. Moreover, the grayish-white or brown product of scarlatinal inflammation seldom appears upon other parts than

the tonsillar or lateral pharyngeal surfaces, whereas the diphtheritic membrane often appears upon the uvula, upon the posterior faucial surface, and in the nares, in addition to the tonsillar surface.

In the anginose variety of scarlet fever the pharyngitis is sometimes so severe, extending so deeply in the tissues of the neck and producing so much infiltration, that the circulation is obstructed, and necrosis or gangrene of the mucous and submucous tissues results, usually upon the lateral aspect of the fauces. The appearance very closely resembles that in advanced cases of malignant diphtheria. It is sometimes difficult to determine from the gross appearances whether the disease of the faucial surface has resulted from the severity of the scarlatinal inflammation or from a supervening and complicating diphtheria. Of course, a microscopic examination, so as to determine the presence or absence of the Klebs-Loeffler bacillus, enables us to make a clear and positive but delayed diagnosis. Without such assistance we must base the diagnosis on the history of the case and the daily inspection of the fauces. Fortunately, the treatment appropriate for scarlatinal pharyngitis with necrosis and that for severe diphtheritic pharyngitis with a thick, deeply-seated, decomposing pseudomembrane are nearly the same.

Herpetic Pharyngitis.—No one can mistake herpes of the fauces in its commencement for diphtheria, the minute vesicles of the former disease are so unlike the diphtheritic exudate. But when the vesicles have disappeared and are replaced by minute ulcerations covered by a white and adherent exudate, the differentiation of herpes from benign diphtheria may be difficult. The presence of herpes labialis affords presumptive evidence that the pharyngitis is herpetic, but not conclusive, for labial herpes is sometimes present in diphtheria. Immediately after the disappearance of the vesicles, small rounded concretions, distinct from one another, occupy their place, presenting an appearance unlike that of diphtheria, which at first exhibits a film that becomes thicker and firmer subsequently. It is when the concretions unite, forming a patch, that the liability occurs of mistaking the disease for diphtheria.

Ultero-Membranous Pharyngitis.—This is an extension of ulcero-membranous stomatitis. It is characterized by a necrosis, limited in extent and superficial, of the mucous membrane. The presence of ulcero-membranous stomatitis as the important part of the disease predominating over the pharyngeal affection aids to a correct diagnosis. Constitutional symptoms are slight or are wanting in this form of pharyngitis. Fever, albuminuria, and glandular swellings, which characterize diphtheritic pharyngitis, are absent or insignificant. The sphacelus over the tonsils, unlike that in diphtheria, is in small patches isolated from one another. The microscope reveals epithelial cells and bands of elastic fibres pertaining to the chorion as the elements in the necrosed tissue.

Finally, the grayish-white appearance produced by cauterization with nitrate of silver, and milky spots on the faucial surface, which are caseous

concretions, will not be mistaken for diphtheritic products except by the most careless observer.

PROPHYLAXIS.

The prevention of diphtheria has been much discussed in medical societies and journals during the last few years, and prophylactic measures have been strongly recommended by prominent physicians of large experience. Nevertheless, we read of its prevalence, with a heavy death-rate, in every country reached by commerce and travel; in every part of Europe, in the United States and Canada, in distant Brazil and Australia. Mr. Janssens, Medical Director of Statistics in Brussels, states that the annual deaths from diphtheria in England, Belgium, Holland, Switzerland, Italy, France, Germany, Scandinavia, Russia, Spain, Austria-Hungary, and America are from forty-one to one hundred and forty in every one hundred thousand inhabitants, the largest number being in America, and a recent French writer deplores the fact that the aggregate deaths in France exceed the births. He adds that this heavy mortality is largely due to the prevalence of diphtheria.

Nevertheless, observations abundantly show the efficiency of prophylactic measures when properly and early employed. Dr. H. B. Baker, of Michigan, has published statistics showing that in one hundred and two outbreaks of diphtheria the average number of cases where disinfection and isolation, one or both, were neglected was 16, and the average deaths 3.26, while in one hundred and sixteen outbreaks in which isolation and disinfection were enforced the average number of patients in each outbreak was 2.86, and the average deaths 0.66. Therefore these prophylactic measures prevented thirteen cases and 2.57 deaths, in the average, for each outbreak: in the total, fifteen hundred and forty-five cases and two hundred and ninety-eight deaths. These statistics relate to one year.¹ Dr. Grancher, Professor of Diseases of Children in the Faculty of Medicine, Paris, states that in a ward set apart for diphtheritic patients in the institution with which he is connected seventeen hundred and forty-one patients have been admitted during a series of years, and of these one hundred and fifty-three children have been found, after their admission, not to have diphtheria, and yet, by the prophylactic measures employed, not one of them contracted it.² Dumez states that in a school the boys and girls on the same floor were separated by a hall a few yards wide. Diphtheria occurred among the girls. By strict isolation, and allowing no communication across the hall between the boys and girls, the boys escaped. In the New York Foundling Asylum the isolation of the patient affected with diphtheria or scarlet fever, and of his or her nurses, in a small room adjoining one of the main wards, has repeatedly proved an effectual quarantine, although the same measures have been inadequate as regards measles or whooping-cough.

¹ See the *Annual of Universal Medical Sciences*, 1888.

² *Revue d'Hygiène*, December 20, 1890.

The physician, when summoned to a case of diphtheria, however mild, should never forget the manifest and very important duty of preventing, so far as possible, its propagation to others while he endeavors to cure the patient. The remarkable success in preventing the propagation of diphtheria achieved by Professor Grancher, so that of one hundred and fifty-three patients not having diphtheria and admitted by mistaken diagnosis among diphtheritic patients not one contracted the disease, is instructive. The following are the measures so successfully employed by him. A metallic screen surrounds the bed occupied by the patient, and all articles used by him, as spoons, forks, and napkins, are disinfected immediately by being placed in about one pint of boiling water containing about one ounce of sodium carbonate. The bedding and the clothes used are disinfected by heat, and the floor, bedstead, and walls are washed with the corrosive sublimate solution. Nurses and medical attendants wear blouses that are disinfected by heat each day, and they bathe themselves with a solution of corrosive sublimate or a five-per-cent. solution of carbolic acid. The success obtained by Grancher in a public institution by prophylactic measures justifies the belief that it is possible by their early and continuous employment and the intelligent co-operation of families to limit each outbreak of diphtheria to one or a few cases.

Prophylactic Measures to be employed in the Sick-Room.—Usually when the physician is summoned to a case the diagnosis has not been made. It is necessary to examine the fauces at the first visit in order to make the diagnosis, and at subsequent visits in order to ascertain the progress of the disease. If diphtheria be suspected or ascertained, the physician should, before entering the sick-room, remove his coat and vest, and cover his body, neck, and extremities with a blouse, as Grancher recommends, or with a sheet fastened around the neck. In examining the fauces most physicians sit in front of the patient, and in depressing the tongue a cough is usually excited, so that particles of muco-pus or of pseudo-membrane, if it be present, are likely to be ejected upon the face or neck or chest of the physician. This infectious substance, however small, may communicate the disease to others. Not long since a New York physician who examined a case with me, seeing the precautionary measures which I employed, stated that they recalled to mind a painful family experience. A patient, whose fauces he was examining, coughed in his face, and he was conscious at the time that something lodged in his beard, but, his attention being diverted to other matters, he forgot to bathe his face and beard with a disinfectant, and returned home. His child of three years came to him, and after the usual incubative period sickened with a fatal form of diphtheria. It is not difficult to examine the fauces of a child, standing by his side or behind him. It has been proposed, also, to examine the fauces through a pane of glass set in a convenient frame, which would allow a good view and intercept any ejected particles of muco-pus or pseudo-membrane.

When the physician has completed his examination and is about leaving

the family, he should bathe his head, face, beard, and hands in an antiseptic lotion, as one of corrosive sublimate. It is evident that all articles not required for the comfort of the patient, as the carpet, curtains, pictures, and decorations, should be removed as soon as the diagnosis is made, and no one should be admitted into the sick-room except the physician and those who nurse the patient. The prophylactic measures to be employed as regards other children in the family, if there be any, are important. Formerly I sent them from the house, without other precautionary measures, and after the usual period some of them sickened with the disease. A better result is obtained by bathing the entire surface of each child, as soon as the diagnosis is made, with an antiseptic lotion, changing its clothing for garments that are new, or have not been infected, or have been disinfected by heat, and spraying, during the ensuing week, its mouth and fauces, as often as every third hour, with a mixture of one part of peroxide of hydrogen and ten parts of water, and its nostrils with a mixture of one part of the peroxide and fifteen parts of water. This treatment, with prompt removal from the house, or from the room or rooms communicating with the patient, will, according to my observations, rarely fail to prevent the occurrence of diphtheria in other members of the family. Even with the precautionary measures which I have mentioned, the physician should, in my opinion, in his subsequent visits to families, during an hour or two, avoid close proximity to other children.

Health Boards deserve commendation for the good work which they accomplish in suppressing the infectious diseases. Small-pox, a common and fatal disease in New York City thirty-five years ago, is virtually suppressed, and the other fatal infectious diseases would doubtless be more prevalent except for the stringent measures looking to the protection of families and the schools employed by Health Boards. Nevertheless the day will probably never come when we can say of diphtheria, as we can of small-pox, that it is virtually suppressed. The difficulties attending the suppression of diphtheria will be apparent from the narration of the following case :

On a cold day in the latter part of January, 1892, I was requested, in making my rounds, to call upon a poor but deserving family in Fifty-Third Street, between Ninth and Tenth Avenues, who were in need of a physician. On arriving at the number I found a five-story tenement house, now so common in the poor quarters of New York, and learned, on inquiry, that Mr. G., whose child was sick, lived on the third floor. Feeling my way along the narrow passages, dark even in the daytime, I was admitted into the sick-room, ascertained by subsequent measurement to be twelve by fourteen feet. The occupants of the room were Mrs. G., pale and careworn, and in her arms a child of about two years, whose guttural respiration was audible as soon as the door was opened. Its nostrils and cheeks were sore from the abundant acrid discharge, and a large indurated swelling on each side of the neck extended from the ear downward. A moment's glance,

without nearer approach, enabled me to say that the child had malignant diphtheria, so far advanced that its death was certain within two or three days. The mother stated that it had been sick four days, that her husband could not obtain work, and that she had not called a physician because she had no more money than was needed to buy coal and bread and satisfy the demands of the landlord for rent. Through a half-open door leading into a bedroom seven and a half by ten feet, too cool to be safely occupied, I saw three children, aged five, seven, and nine years, silently gazing at their mother and wondering at her grief. They reminded me of the penned sheep or calves in the East Side slaughter-houses, seeing their companions one after another led out to slaughter, and quietly and resignedly awaiting their turn. The mother said that she had two other children, who were attending a public school and were at home except during school hours. When questioned as to the origin of the sickness, she stated that she was not aware of any exposure to a case of diphtheria, but that offensive odors, due to escaping sewer-gas, were frequently noticed. I am informed that, since the case of diphtheria was reported, examination of the plumbing throughout the house has been made by the Health Board, and it is found to be of the old style in all parts of the building, and entirely inadequate to exclude the effluvium from the sewer. This escape of the sewer-gas is a constant source of peril to the twenty-two families occupying the house. The child that I visited lived two days.

The above case is related in order that we may perceive how difficult it is to prevent diphtheria in the large cities with their tenement houses crowded by poor families, who frequently do not send for the physician or know the nature of the disease until the case has continued several days and many have been exposed. Among well-to-do people, occupying large rooms and having vacant rooms which can be employed for quarantine purposes, and who send for a physician and know the nature of a malady soon after it begins, it is much more easy to prevent the propagation of diphtheria than in the crowded apartments of the poor.

It will be observed that two of the children in this family, constantly exposed when at home to malignant diphtheria, had been attending one of the public schools during the four days of the continuance of the case. Since many cases of diphtheria originate from exposure in the schools, the protection of school-children is a matter of very great importance. The New York Health Board no doubt prevent many cases by excluding from the schools all the children coming from a domicile in which an infectious disease is occurring as soon as it is reported; but more stringent measures are required. Dr. Augustus Caillé, in an instructive and suggestive paper read before the American Pediatric Society in 1890, remarks as follows: "For each school one or more sanitary inspectors should be appointed whose duty it would be to see that the rooms are not overheated, and to make a rapid but efficient inspection of the children's throats as they enter or leave school. No tongue-depressor should be used, and the children

should be taught to use their own fingers as a tongue-depressor. Each child who is found to be affected with an inflamed throat, nasal catarrh, cutaneous eruption, ophthalmo-blennorrhœa, or any other plain evidence of disease, should at once be sent home, with a printed card announcing, 'Your child is sick; take it to a physician or dispensary.' Some plan like this would probably be feasible, and would afford additional protection to the schools; but I would suggest that the printed card read, "Your child is sick; call the family or dispensary physician," and that each pupil be questioned whether there is sickness at home.

But what is very much needed, and is perhaps possible, is that the infectious principle of the disease which we are considering be destroyed in the sick-room, or its formation prevented. The results obtained by Professor Grancher encourage the belief that this is possible.

What, then, in brief, should be employed in the sick-room to destroy or antagonize the specific principle of diphtheria, the microbes, and their poisonous product, which cause this disease? Wash the bedstead, floor, and walls of the room every day with a solution of corrosive sublimate, making use of prophylactic measures similar to those which have been so successfully employed by Professor Grancher.

Since the air exhaled in the breath of the patient and arising from his surface is the chief vehicle by which diphtheria is communicated, I have for some years prescribed the following disinfectant, and believe that it aids materially in achieving the desired prophylactic result:

R Olei eucalypti,
Acidi carbolici, ãã ʒi;
Terebinthinæ, ʒ viii.
Misce.

Add two tablespoonfuls of this mixture to one quart of water, and allow it to simmer constantly near the patient in a vessel with a broad surface, as a tin or zinc wash-basin, a vessel with a broad surface being needed so that it shall not take fire. The vapor produced is strong and penetrating, but not unpleasant. During the half-dozen years in which I have employed it I have been more and more impressed with the belief that it does exert a decided prophylactic action.

Mr. Charles Smith, member of London medical societies but at present an Australian practitioner, has recently published in a medical journal a strong recommendation of the above prescription, but his mode of employing it is different. He prescribes one ounce each of oil of eucalyptus and carbolic acid, and four to six ounces of turpentine. Instead of evaporating the mixture in water over a lamp, he saturates cloths a foot square with it and places them on paper on the bed of the patient, so that the air of the room is strongly impregnated with the vapor. Mr. Smith states that patients with diphtheria who constantly inhale this vapor and recover do not have subsequent paralysis. From my own observations as regards

the effects of this antiseptic mixture, I have no reason to doubt the truth of Mr. Smith's statement. If it be true, it must destroy or prevent the formation of the poison secreted by the bacillus.

I expect henceforth, when the weather is hot, and increase of heat in the room would add to the discomfort, to recommend his mode of employing the disinfectant.

Such, then, are the measures which in my opinion are most likely to prevent the propagation of diphtheria and limit its occurrence to one or a few cases. I may summarize them as follows: strict isolation of the patient, and the removal from his room of all articles not required; proper ventilation of the sick-room without draughts of air, and constant disinfection of the air of the room by a disinfecting vapor like that given above; the constant employment of prophylactic measures, including personal disinfection, so that the physicians and nurses shall not become infected; the frequent spraying or irrigation of the mouth, fauces, and nostrils of the patient by a safe and efficient disinfectant, properly diluted, as the peroxide of hydrogen; the frequent washing and disinfection of utensils and bedding, as practised by Professor Grancher; and the washing of the bedstead, floor, and walls of the room, each day, with a solution of corrosive sublimate.

Disinfection of the sick-room after the termination of the case by burning sulphur in it, with the doors and windows closed, is inadequate as frequently practised,—that is, by burning the sulphur dry. I have elsewhere related the test of this in the New York Infant Asylum, in which two pounds of sulphur to each one hundred cubic feet of air were burnt dry. More sulphur was employed than is recommended by the New York Health Board, but cultures from the dust removed immediately afterwards produced abundant microbes.

Dr. E. R. Squibb, in commenting on the inadequacy of sulphur fumigation as shown in the above instance, remarks as follows: "Nearly all, if not all, chemical disinfectants are in a state of tension, ready to change on coming in contact with the matter to which they are applicable; and these changes are either by oxidation or deoxidation, and the moment of greatest power or activity is the moment of change, when they by reacting on infectious matter pass from a state of tension to a state of rest, under new relations. The agency through which these changes almost universally become operative is the vapor of water. When sulphur is burned in a close chamber, the dioxide is formed by condensing two molecules of oxygen from the air upon each molecule of the sulphur, and a heavy gas is the result, which tends to settle at the bottom of the chamber and run out through the cracks." This dry gas seizes upon the moisture present, becoming sulphurous acid and by further change sulphuric acid. It is during these changes, which are promoted by the aqueous vapor present, that the power of the sulphur-gas as a disinfectant is exerted. The burning of sulphur as a disinfectant should always, therefore, be in a room con-

taining an abundant supply of moisture. It was employed in the maternity ward, as related above, in a dry state.

In the city tenement houses not a few families move away after the termination of the sickness, leaving vacant rooms that are never disinfected, and those who intend to remain must, of course, vacate their apartments if the disinfection be by burning sulphur. Hence the infected apartments in tenement houses are often not disinfected when disinfection is urgently required. A mode of domiciliary disinfection is needed which can be employed while the apartments are still occupied. The advantage of disinfecting by the solution of corrosive sublimate, which can be applied over the floor and walls of the room and upon the bedstead and utensils not only when the case terminates, but also during its continuance, is apparent. This use of corrosive sublimate, with, in many instances, painting, calcimining, or whitewashing of the walls and ceiling, which, if it does not destroy, at least covers the microbes, is the accepted mode of domiciliary disinfection in the asylums of New York.

TREATMENT.

The fact that diphtheria now occurs in every or nearly every country reached by commerce or travel, that it is established or endemic in the cities even in the medical centres under the best sanitary regulations, and that numerous epidemics of it are constantly occurring in rural localities in both hemispheres, with a large percentage of deaths, has, as might be expected, led to the discussion of its treatment beyond that of most other diseases. Nevertheless there is a diversity of opinions in regard to the use of therapeutic agents. One physician recommends, as eminently successful in his practice, a medicine or mode of treatment of which another speaks disparagingly. This diversity of opinions in reference to remedies is due in part to variations in the type and severity of diphtheria in different epidemics and localities, and in part to the fact that other forms of inflammation have been incorporated in and have vitiated the statistics of treatment. The theory, now established and accepted, that diphtheria is caused by microbic agency and is primarily a local malady, obviously has a marked influence on the mode of treatment.

Hygienic Measures.—These are to a certain extent already discussed in our remarks on the prophylaxis. The patient should be in an airy room, and his evacuations should be in a vessel containing a disinfectant, as a solution of corrosive sublimate, chlorine, or carbolic acid, and be promptly removed from the room. Purity of air in the apartment is required, but in the ventilation draughts of air should be avoided, on account of the liability to diphtheritic croup, which produces about one-third of the deaths from diphtheria. M. Jules Simon recommends that the windows of the sick-room be constantly closed, and that ventilation be obtained through the open window of the adjoining apartment. Local bathing of the patient with the sponge is preferable to the general bath, and care must be taken

that he be not chilled during the process. The patient should be constantly in bed, and the temperature of the apartment should be from 70° to 75° F. A uniform temperature of the apartment at about 73° is safest.

Physicians of experience recognize the importance of the use of the most nutritious and easily digested food and the preservation of the appetite, for diphtheria causes rapid destruction of the red corpuscles and loss of flesh and strength, and it may soon produce a state of dangerous weakness. Many years ago Trousseau wrote, "Alimentation occupies the first place in the general treatment," and I have observed that the severer the attack the more imperative is the necessity to sustain the patients with nourishing food. Loss of appetite—that is, disgust for every kind of food—is one of the most alarming prognostic signs. We must try to overcome the loathing of food by every possible means, and to get nourishment taken I sometimes do not hesitate, in the case of children, to threaten punishment. When the patient retains his appetite for food there is good hope of recovery. Beef-tea, or the expressed juice of meat, milk with farinaceous food, etc., should be administered every two or three hours, or to the full extent without overtaxing digestion. I have sometimes employed the pepsin preparations before each feeding, with apparently good results, as in the following formula :

R Pepsini puri in lamellis, ʒi;
Acidi muriatici diluti, fʒii;
Glycerini, fʒi;
Aquæ puræ, fʒiv.—Misce.

Dose, one teaspoonful before each feeding for a child of five years.

In cases of feeble digestion the predigested foods are often useful, as peptonized milk, the beef peptonoids, or sarco-peptones.

In certain cases, when deglutition is difficult, whether from the severity of the pharyngitis or from palatal paralysis, alimentation should be promoted by the use of the stomach-tube with a small funnel-attachment, or by rectal enemata. The rectum absorbs, but does not digest, and it is capable of absorbing peptonized food to such an extent that life may be sustained for an indefinite time without stomach-digestion, and solely by rectal alimentation. For this purpose peptonized milk containing in solution one of the sarco-peptones or predigested beef extracts should be used. If administered per rectum, through a No. 12 or No. 14 elastic catheter, introduced far enough to enter the sigmoid flexure, and retained for half an hour by a compress pressed with the fingers closely against the anus, better results are obtained than when we depend, as Trousseau did, entirely on stomach-digestion. One objection to the use of the brush, instead of spraying the fauces with the atomizer, is that it is more likely to cause vomiting, by which nutriment, that is so much required, is lost. In severe cases of diphtheria attended by profound blood-poisoning, as in scarlet fever of a similar type, patients are sometimes allowed to slumber too long with-

out nutriment. It is the slumber of toxæmia, and should be interrupted at stated intervals in order to give food and stimulants.

• LOCAL TREATMENT.

Germicides.—Solvents.—Diphtheria being primarily local, it is evidently necessary, in order to eradicate or reduce the disease to its minimum and prevent blood-poisoning, to apply germicide and solvent remedies to the inflamed surface as early as possible and frequently. A great improvement has been made in the local treatment of diphtheria by the discovery of the microbic cause of the inflammation. Fortunately, with the better knowledge of the nature of diphtheria, the belief is becoming prevalent in the profession that the destruction of the exudate by caustic agents, and even by the actual cautery, as practised in the age of Bretonneau and Trousseau, and recommended by the highest authorities, not only does no good but is pernicious. It is painful to read in the writings of so good an observer as Trousseau, "Pure fuming acid [hydrochloric] may be employed without hesitation, and cauterization with it may be repeated three or four times in the twenty-four hours." Caustic applications having destructive but not antiseptic properties do more harm than good. They increase the inflammation, and are commonly followed by an increase in the amount of pseudo-membrane. The employment at short intervals of mild but penetrating and efficient lotions or sprays having antiseptic but non-irritating properties has now properly come into favor, and is instrumental in saving many lives. But antiseptic vapors, lotions, and sprays, although of the best kind, may not produce complete disinfection if the pseudo-membrane be of great thickness. Its under surface, which is in immediate relation with the lymphatics and blood-vessels, and from which systemic infection occurs from absorption of the poison elaborated by the Klebs-Lœffler bacillus, is probably not reached by the antiseptic sprays or lotions commonly employed. Any painless and unirritating application which diminishes the thickness of the pseudo-membrane by its solvent action, or, better, entirely dissolves and removes it, is therefore highly useful. Of the unirritating solvents, weakened alkalies, pepsin, trypsin, and papayotin have until recently been chiefly used, and, to a certain extent, have deserved the confidence of the profession. The efficiency of solvent treatment depends, of course, on the agent used and the mode and frequency of its application. Lime-water employed by spray or irrigation, or the spray of slaking lime, constantly or frequently used, has been largely prescribed for its supposed solvent action, but this effect can be increased by adding to it an alkali, as sodium bicarbonate. The following formula may be employed :

R Olei eucalypti, f ʒ ii;
 Sodii benzoat., ʒ i;
 Sodii bicarbonat., ʒ ii;
 Glycerini, f ʒ ii;
 Aquæ calcis, Oj.—Misce.

To be used with the hand-atomizer from three to five minutes every half-hour, or with the steam-atomizer almost constantly. This alkaline vapor seems to exert some solvent action on the pseudo-membrane, and also renders the muco-pus less viscid, and therefore so changes its character that it is more easily expectorated.

The use of pepsin as a solvent is suggested from its well-known action in digesting nitrogenous substances. It has been employed with varying results. It is well known that some of the preparations in the shops are more active than others, and hence, perhaps, a chief reason for the difference in the results obtained. It is well to remind the reader that it should be employed alone, or with an acid, for it is comparatively inert if used with an alkali. Rossbach states¹ that he has used a solution of papayotin, or vegetable pepsin, frequently applied to the fauces. In young children a few minims may be placed on the tongue every five minutes. If the drug be good, he states, the membrane is dissolved in two or three hours. Dr. Jacobi says that this agent is readily dissolved in twenty parts of water, so that it may be brushed over the surface or used as a spray. Mixed with water and glycerin in greater concentration (one to four to eight) it has been used by him with fair results. Dr. J. K. Bauduy, Jr., also writes favorably of the solvent action of papayotin on the pseudo-membrane.²

Trypsin, unlike pepsin, is an active solvent in an alkaline medium, and it may therefore be added to alkaline mixtures. Dr. F. C. Fernald relates the case of a boy of six and a half years who had perforation of each membrana tympani and began to complain of sore throat. A pseudo-membrane appeared upon the tonsillar portion of the fauces, and the right auditory canal was covered by a diphtheritic exudate entirely occluding it, so that liquids did not flow from the external ear into the fauces as formerly. The ear was filled every half-hour with the following mixture: *R* Trypsin, gr. xxx; sodii bicarb., gr. x; aquæ destillat., f ʒi. The pseudo-membrane in the ear gradually dissolved and disappeared, the passage through the ear and the Eustachian tube became open, and the patient recovered.³ Certain vegetable substances not regarded as actively antiseptic or solvent are prescribed by physicians of prominence for the local treatment of diphtheria, as acetic acid by Professor Henoeh, pineapple juice, etc. Time will determine their efficacy and value.

Potassium Chlorate.—We will consider in our remarks on the internal treatment those medicines which are chiefly employed as internal remedies, although they have a local action, such as tincture of iron and corrosive sublimate. But potassium chlorate should be considered in this connection, since it has been largely prescribed, and is still in some places, as a local remedy. Its beneficial action when employed in various forms of stom-

¹ St. Petersburg Medicinische Wochenschrift, 1886.

² Weekly Medical Review.

³ Medical News.

atitis and gingivitis led to its extensive use in pharyngitis. When taken internally it is eliminated in part by the salivary glands, so that it continues to exert an action on the surface of the mouth and fauces until it is eliminated. It has of late years become almost a domestic remedy, but the laity should be cautioned in reference to its use. It is an irritant to the kidneys in large doses, producing intense inflammatory congestion of these organs and arresting their function. The melancholy fate of Dr. Fountaine, of Davenport, Iowa, in 1861, whose life was sacrificed by an experimental dose of potassium chlorate, is remembered by the older physicians. Fountaine took half an ounce in a gobletful of water at eight A.M. Free diuresis occurred, which ceased at four P.M. Though fatigued and pallid, he ate a hearty supper. During the following night he was in collapse, with vomiting and purging and severe abdominal pain. Early in the following morning he voided two ounces of dark urine, after which no urinary secretion occurred. The choleraic symptoms returned, with collapse, but he again rallied. He had vomiting and intense and constant abdominal pain during the subsequent six days, when death occurred. The total cessation of fecal and urinary evacuations for six days was a notable fact. At the autopsy the lesions of an intense and general gastro-intestinal inflammation were present, the mucous membrane hanging in shreds and patches; the bladder was empty, and its mucous membrane presented a similar appearance to that of the stomach and intestines. The condition of the kidneys is not stated, except that there was a liquid resembling urine under the capsule of one kidney, and crystals of the chlorate were in the pelves of the kidneys. A few years since, in my practice, a child of three years, with active diphtheritic pharyngitis, was allowed to quench its thirst by drinking water from a small pitcher in which three drachms of potassium chlorate, which had been ordered as a gargle, had been dissolved. In the morning I was summoned in haste, and found the surface of the patient cold and blue and pulse feeble. The urine was totally suppressed, and instead of it a few drops of blood passed from the urethra. Death occurred before night.

M. Jules Simon¹ says that potassium chlorate, useful locally in throat-affections, produces no benefit in diseases of the fauces, and it weakens the little patient when given in large doses. Dr. J. P. Esch says that he has observed that when used internally it almost invariably causes nephritic symptoms, and Ferguson² totally condemns its use in any dose or mode of administration in diphtheria. In every case in which he employed it, if albumin were present in the urine it was invariably increased. Von Focke believes that any benefit which may be derived from potassium chlorate in diphtheria results from the oxygen in it. To render the oxygen more efficient he adds hydrochloric acid one and a half per cent. to a two-

¹ *Le Progrès Médical*.

² *Canadian Practitioner*.

per-cent. solution of the chlorate, and administers half a teaspoonful to two teaspoonfuls, according to the age, every one to two hours. All the benefit obtained from this mixture may apparently be derived from the following prescription, which, with some variations, has been long employed in New York, and probably more frequently prescribed than any other remedy :

R Tinct. ferri chloridi, fʒ ii-ij ;
 Potas. chlorat., ʒ ss ;
 Acidi hydrochlorici diluti, gtt. x ;
 Syr. simplicis, fʒ iv.—Misce.

Dose, one teaspoonful hourly or each second hour.

After so extensive a use of potassium chlorate during nearly half a century, its therapeutic action should be clearly ascertained, and any ill effects which may result, fully determined. From what is now known of its action, it would probably be better to abandon its use in diphtheria, since it is a remedy of doubtful efficacy for this malady and may in some cases do much harm. If it be employed it should be in small doses sufficiently diluted, and not more than half a drachm should, I think, be given in twenty-four hours to a child of five years.

Salicylic Acid.—Among the remedies prescribed for the local treatment of diphtheria by prominent clinical observers in Europe, but less frequently in this country, salicylic acid may be mentioned. Jules Simon prescribes it in the following formula, to be used by brush, spray, or gargle :

R Acidi salicylici, centigram. 50 ad gram. 1 ;
 Alcoholis, q. s. ad solut. ;
 Glycerini, gram. 40 ;
 Infus. eucalypti, gram. 60.
 Misce.

Hallepeau employs the following prescription :

R Aquæ,
 Glycerini, aa gram. 20 ;
 Acidi salicylici, centigram. 50 ;
 Alcoholis, q. s. ad solut.
 Misce.

M. D'Espine undertook a series of experiments in order to determine the efficacy of different antipyretics, and he gave the preference to salicylic acid in the strength of one and a half to two parts in one thousand.

Other distinguished Parisian physicians might be mentioned who prefer salicylic acid for local treatment to the other remedies commonly employed. On the other hand, Cadet de Gassicourt and Loeffler may be mentioned among those who do not regard it as an efficient remedy. The fact that it is seldom prescribed in America is probably due to the greater and increasing confidence in certain other remedies used locally, as the peroxide of hydrogen.

Sulphur.—The use of sulphur in the local treatment of the fauces has

constantly had its advocates from an early date in the history of diphtheria. It would probably be more employed except for the fact that gargles and sprays are in use that are equally or in a higher degree antiseptic and solvent and at the same time are not so unpleasant to the patient. A good mode of employing it is that recently recommended by Dr. G. F. Cadogan-Masterman.¹ Two mixtures are prepared, as follows :

R Sodii hyposulphitis, ʒii;
 Aquæ puræ, fʒ viii.
 Misce.

R Acidi hydrochlorici diluti, fʒ iii;
 Aquæ puræ, fʒ viii.
 Misce.

Mix one tablespoonful of each in the bottle of the hand-atomizer and spray immediately. A milk of sulphur forms in the finest possible subdivision. Only so much should be mixed as is needed each time, since the sulphur soon settles in a firm cake.

Other Local Remedies.—Professor Henoch, of Berlin, President of the Pediatric Section of the Tenth International Medical Congress, and one of the highest authorities on diseases of children, states in a paper published April 11, 1891,² that after many disappointments he now prescribes a spray of acetic acid for young children and a gargle for those that are older. Perhaps he prescribes this remedy on account of the statement made by MM. Roux and Yersin, that acidulation of the diphtheritic products diminishes their virulence. But the results of treatment by acetic acid are not encouraging. In one hundred and ten cases of genuine diphtheria treated by him the inflammation was limited to the pharynx or to the pharynx and nares, and of these thirty-two died. In eighty-two cases the inflammation extended to the larynx, producing diphtheritic croup. Twelve of these were too sick and feeble for operative measures, and, of course, perished. In the remaining seventy tracheotomy was performed, but only nine of the number, or thirteen per cent., lived.

M. Grancher recommends the removal two or three times daily of the pseudo-membrane by a stiff camel's-hair pencil or a swab of absorbent cotton, or in some instances by the forceps, and the application immediately afterwards of a mixture consisting of twenty grains of camphor, five grains of crystallized carbolic acid, fifteen grains of castor oil, ten grains of alcohol, and one grain of tartaric acid. In the interval a spray or gargle of a one-per-cent. solution of carbolic acid is employed every two hours.

It would consume too much time and space to detail the modes of local treatment and the many remedies that have been recommended for local use in the medical journals during the last two or three years. But in the

¹ Provincial Medical Journal, December 1, 1890.

² Centralblatt für Klinische Medicin.

United States and Canada a decided improvement has apparently been recently made in the local treatment of diphtheria by the use of the peroxide of hydrogen. Employed in the irrigation of the fauces and nares by spray or gargle, it is the most powerful of the known germicides that can be safely used. It does not inflame or injure the mucous membrane to which it is applied; it has no poisonous properties, and is highly penetrating, so that it cleanses and disinfects the surface and sterilizes the pseudo-membrane to a greater degree than most other germicides. At the same time it is believed to exert a solvent action, gradually rendering the pseudo-membrane thinner and hastening its disappearance.

The peroxide of hydrogen should be used as early as possible,—as soon as the diagnosis is made, and even when it is doubtful. It should be applied every hour, and in grave cases every half-hour, preferably by the hand-atomizer, over the faucial and usually also the nasal and post-nasal surfaces, and the application should be thorough, from five to ten compressions of the bulb being necessary for each surface. There seems to be considerable difference in the quality and efficiency of the peroxide coming from different laboratories. Marchand's is the one with which I am most familiar. No one in America is more competent to express an opinion of the nature and value of new remedies than Dr. E. R. Squibb. In a paper prepared for the New York State Medical Association and bearing the date October 30, 1890, he says, "Peroxide of hydrogen, H_2O_2 , has increased very rapidly in usefulness during the past year, and in fact it has had a steady growth ever since its introduction. It is no doubt the most powerful of all antiseptics and disinfectants. There are now several good manufacturers of the article, which creates a healthy rivalry, and thus a reliable article is pretty sure to be kept on the market. It has been used to a considerable degree in diphtheria and throat and lung affections for the past year or two, and up to the present time has rarely failed to do its work. When it does fail it will be found to be due in the majority of cases to lack of care in keeping, or attempting to use from the remainder of a bottle which has been long kept, and possibly been often dispensed from, and thus repeatedly exposed to outside air and the dust and dirt accompanying it. Surgeons in general, and obstetricians and gynecologists in particular, are appreciating its usefulness more and more." The purpose obviously of the use of the peroxide is to destroy the microbic cause of diphtheria, and to prevent or destroy the poison which it elaborates and which causes the systemic infection. According to my observations, it is sufficient for the accomplishment of this object to prescribe for the fauces one part of the peroxide to ten parts of water, and for the nostrils one part of the peroxide to fifteen parts of water. The application of this dilution of the peroxide made every half-hour to every hour with six to a dozen compressions of the bulb produces the full antiseptic and germicide action of this drug.

But clinical observations show that the commercial peroxide of hydrogen has in some instances done harm. Like most new remedies, it

has had its set-back by the report of unfavorable cases. Dr. J. R. Espey states that he had employed the peroxide in several cases with a good result, prescribing it diluted one-half, as a throat-wash, applied with the atomizer. A patient thus treated had nearly recovered, only a slight membrane remaining on one tonsil and presenting a rotten, swollen appearance as if about to be detached. Unfortunately, at this time the retail druggist received a fresh supply of the peroxide, made by a different manufacturer. When this was used in the atomizer, the child, who had previously been quiet and docile under treatment, cried with pain, and Dr. Espey was sent for in haste. He found a thin grayish membrane covering the tonsils, uvula, and posterior pharynx, and the mucous membrane of the fauces and mouth was red and angry-looking. The throat-wash was omitted, but the new membrane continued one week. Dr. Espey gargled his own throat with the new peroxide and experienced a sharp burning sensation like that from ammonia. He records a second similar case from the use of the peroxide obtained from the same source.

Cases showing the harmful effects of the peroxide were also related by Drs. Jacobi and Caillé at the meeting of the American Pediatric Society held May 12, 1892. The unfavorable results observed are due to the irritating action produced either by the nascent oxygen, which is the antiseptic agent, or by some chemical substance employed in its preparation. If diluted in the proportion of one part of the peroxide of a fifteen-volume strength to ten parts of water for the fauces or to twelve or fifteen parts for the nares, I have observed no injurious results. But the nurses or parents first employ the spray upon themselves, and if it cause smarting more than five minutes it is still more diluted.

In a large proportion of cases the spray employed as recommended above suffices for the local treatment of diphtheritic inflammation of the fauces and nares, but in certain cases all the resources of our art are required to check the morbid process and rescue the patient from the impending danger. In these grave cases the following mixture applied by the camel's-hair pencil to the faucial surface every three or four hours is very effectual, immediately converting the pseudo-membrane into an inert mass, and destroying the microbes which swarm in it, as I have observed under the microscope :

R Acidi carbolici, gtt. x;
 Liq. ferri subsulphatis, fʒ iii;
 Glycerini, fʒ i;
 Aquæ puræ, fʒ ii;
 Misce.

This application is not irritating, but it is dreaded by most children, on account of the unpleasant "puckering" which it produces, and the pain, which sometimes extends to the ear, caused by the powerful contraction of the faucial surface. It always, however, gives satisfaction to the friends, for it not only brings away particles of the pseudo-membrane, but it

sterilizes and coagulates the muco-pus, which then comes away in friable masses, which are mistaken by the laity for pseudo-membrane. From its highly penetrating properties it appears to produce for the time as complete sterilization of the surface to which it is applied as can be produced by any spray or irrigation.

One more mode of the local treatment of diphtheria requires attention. At the meeting of the American Pediatric Society in Washington in September, 1891, Dr. Seibert, of New York, recommended a new mode of the local treatment of diphtheria, and exhibited the instrument employed by him. The peculiar merit of Dr. Seibert's method consists in the endeavor to destroy the microbes in the deeper portions of the pseudo-membrane and in the underlying mucous membrane, which, Dr. Seibert says, are not reached by the ordinary treatment. The instrument devised by him consists of five needle-points, like the points of a hypodermic syringe, only much shorter, arranged on a flat disk. Their length is sufficient to penetrate a pseudo-membrane of ordinary thickness and the underlying inflamed and swollen tract, so that the antiseptic fluid is ejected into these parts. The points wound the superficial capillaries and cause some hemorrhage. The liquid employed by Dr. Seibert is freshly-made chlorine water of the U. S. Pharmacopœia. In the discussion following the reading of this paper both favorable and unfavorable opinions were expressed, an apparently valid objection being the fact that this operation, by wounding the blood-vessels, might facilitate the entrance of germs and their poisonous products into the circulation.

INTERNAL TREATMENT.

Stimulants.—Alcoholic stimulation is justly regarded in all countries as highly useful, affording material aid in the endeavor to save life. M. Sanné in his treatise on diphtheria says, "De tous les antiseptiques donnés à l'intérieur, l'alcool est de beaucoup le plus sûr. Plus l'infection est prononcée, plus il faut insister sur les composés alcooliques." Bricheteau reports the history of a patient who took daily during diphtheria a bottle and a half of the wine of Bordeaux, without the least symptom of intoxication or headache. In a case related to me, nearly one and a half pints of brandy were given in twenty-four hours, without any ill effect, and with an apparent good result on the general course of the disease. In diphtheria, as in other acute infectious maladies, while mild cases may do well with little or no alcoholic stimulation, it is required in ordinary cases and in cases of a severe type. In cases of a severe type attended by increasing pallor, anorexia, and loss of flesh and strength due to diphtheritic or septic infection, alcoholic stimulants are required in large and frequent doses. It matters little how the stimulant is administered, whether milk-punch or wine-whey, provided that the proper quantity be employed. If given early and frequently in grave cases,—as, for example, one teaspoonful of brandy or Bourbon whiskey every half-hour or hour to a child of five years,—it

does seem to have a tendency to render the disease more tractable. In malignant cases, to be instrumental in saving life it should be given in large and frequent doses from the beginning of the malady. If there be marked diphtheritic toxæmia when its use is commenced, it will not save life, though it may prolong it. In the quarantine wards of the New York Foundling Asylum in May, 1878, were four children between the ages of three and five years who had been sick a few days with severe diphtheria, and it was evident at a glance that they must soon perish with the ordinary mild sustaining remedies. Quinine, iron, the most nutritious food, and a moderate amount of alcoholic stimulants were being given, and we determined to increase the Bourbon whiskey to one teaspoonful every twenty to thirty minutes, day and night. Nevertheless, whatever the result might have been with the earlier commencement of this treatment, the blood-poisoning was now too profound, and one after the other died. That intoxication is almost never produced in this disease by large and frequent doses of the alcoholic stimulant is probably in part due to its quick elimination from the system, but more to the nature of diphtheria.

Vegetable Tonics.—*Quinine.*—In fulfilling the indication of sustaining treatment, the use of the vegetable tonics is at once suggested, and they have long been employed, especially cinchona and its derivatives. The compound tincture of cinchona and the fluid extract have been used and recommended by physicians of experience, but of vegetable agents quinine has been and is still more frequently prescribed than any other. But the doses of this medicine employed in the practice of different physicians vary greatly in size and frequency. It is administered for its supposed antipyretic effect in large doses, so that from twenty to thirty grains are given daily, and for its tonic effect in small doses, as one to two grains in four hours. That there is nothing antagonistic in the action of quinine to the diphtheritic poison, and that it is beneficial in the same way as in the other acute infectious diseases, and no farther, is, I think, generally admitted by the physicians. Large and frequent doses do not apparently produce any controlling action on the course of the disease, or diminish the blood-poisoning. Cases might be cited in illustration. In the case of a child of four years with malignant diphtheria, forty-eight grains administered daily had no appreciable effect in staying the fatal progress of the disease.

Quinine, in doses of three to five grains, has sometimes been prescribed for its supposed antipyretic effect, but it is a feeble antipyretic in the infectious diseases, and the temperature, after the first two or three days of diphtheria, is not usually so elevated that an antipyretic is required. The late Professor Rochester, of Buffalo, recommended and employed the insufflation of two grains of quinine every two hours upon the faucial surface, believing that its local action is beneficial. But the employment of this agent as an antiseptic by insufflation is very unpleasant to the child, and is likely to be resisted. Moreover, the pharmacopœia contains much more efficient germicides that can be safely used and are not so repugnant. Pre-

scribed in small doses of one or two grains, as in the following formula, for its tonic and appetizing effect, quinine continues to be employed by good observers, and it is probably to a certain extent useful :

R Quininae bisulphatis, \mathfrak{z}^{ss} ;
Syr. yerbæ santæ comp., $\mathfrak{f}\mathfrak{z}^{ii}$.
Misce.

Give one teaspoonful every four hours to a child of five years.

Iron—Tinctura Ferri Chloridi.—Physicians who are familiar with diphtheria have noticed the pallor and loss of appetite, flesh, and strength which commence before the close of the first week in severe cases, and which are unfavorable symptoms, indicating rapid and progressive deterioration of the blood. The use of iron is at once suggested as the proper medicine to arrest this blood-change, from its known effect in increasing the number of red blood-corpuscles and the amount of coloring-matter in these corpuscles. By its effect on the red corpuscles, which are the carriers of oxygen, it increases the functional activity of organs and improves the general nutrition. The ferruginous preparations therefore hold an important place in the therapeutics of diphtheria.

In the *Gazette des Hôpitaux*, in 1859, and in subsequent publications, M. Aubrun, Sr., highly extolled the use of the chloride of iron in diphtheria, and since this time it has probably been used more than any other internal remedy. Ferguson regards the tincture of the chloride of iron as the most valuable of all the remedies for diphtheria. He examined the blood daily, or every second day, in twenty cases of diphtheria, and was astonished to observe how rapidly the red blood-corpuscles were reduced in number, those remaining presenting an unhealthy appearance. He believes that the iron partially arrests the blood-change. He administers as much as can be tolerated. To a child of ten years he gives hourly one teaspoonful of the following mixture in water :

R Tinct. ferri chloridi, $\mathfrak{f}\mathfrak{z}^i$;
Syr. simplicis, $\mathfrak{f}\mathfrak{z}^{iii}$.
Misce.

If the stomach do not tolerate this dose, half a teaspoonful is administered every half-hour. An infant of seven months, greatly prostrated, took every hour one teaspoonful of the following :

R Tinct. ferri chloridi, $\mathfrak{f}\mathfrak{z}^{ii}$;
Syr. simplicis, $\mathfrak{f}\mathfrak{z}^{iv}$.
Misce.

A lady of twenty-two years, having an excessive formation of pseudo-membrane and a very fetid breath, took daily for ten days one and a half fluidounces of the iron.¹

¹ Canadian Practitioner.

M. Jules Simon says, "For internal treatment from three to six drops of the tincture of the chloride of iron should be given in a little water every two or three hours; but it should not be given with milk or gum water or from a metallic spoon, on account of the decomposition which occurs, which may produce digestive troubles."¹ The commendatory remarks in reference to the use of the tincture of iron might be quoted from many experienced observers. That now, after nearly half a century of the constant use of the tincture of iron in diphtheria, there is an almost unanimous verdict in its favor, renders it probable that the few who have not observed its good effects have treated unusually bad cases, or have given it in small and inadequate doses. Dr. Whittier states, in the *Boston Medical and Surgical Journal*, that he prescribed this medicine as the principal remedy in thirty-six consecutive cases in which the fauces were covered with the pseudo-membrane, and all recovered; and he believes that this medicine, given so as to saturate the system, as he expresses it, is the best that can be employed. But it is probable that only a moderate amount of the iron can be assimilated, so that after small doses even the stools are blackened by the portion which is not assimilated. Probably the best vehicle of the tincture of the chloride of iron is glycerin and water, as in the following formula employed by Dr. Billington:

R Tinct. ferri chloridi, fʒi;

Glycerini,

Aquæ, aa fʒi.

Misce.

Dose, one teaspoonful hourly.

But while the large majority of physicians prescribe this medicine in doses of moderate size, in the belief that such doses furnish as much of the medicine as can be utilized, it must not be forgotten that certain physicians of experience have prescribed much larger, even teaspoonful doses, with alleged benefit. The advice of M. Simon should be heeded, not to give it with gum water, nor with milk, nor from a metallic spoon.

Hydrargyri Chloridum Corrosivum (*Hydrargyri Perchloridum*, Br. Phar.).—Acceptance of the theory that diphtheria is caused by a microbe obviously led to the employment of germicide remedies: hence the prominence given to corrosive sublimate among the remedies, since it quickly destroys all micro-organisms with which it comes in contact, and in safe medicinal doses is believed to penetrate all parts of the system. The employment of corrosive sublimate in the treatment of diphtheria is not new, since it appears that the late Dr. Tappan, of Steubenville, Ohio, prescribed it with apparent benefit in 1860 and 1861. However, it was seldom prescribed as a remedy in this disease until within the last few years. The establishment of the microbic theory of diphtheria, and a knowledge of the fact that corrosive sublimate is such a prompt and efficient germicide,

¹ Le Progrès Médical.

have made it the favorite remedy with many physicians. Its employment demands caution, and is justified only by the fact that the disease for which it is prescribed has been very fatal with other modes of treatment. Though this agent is now widely used for diphtheria, medical journals thus far contain very few reports of its supposed toxic or injurious action, while many physicians believe that it diminishes the virulence of diphtheria and increases the percentage of recoveries.

In ordinary cases the following may perhaps be regarded as about the proper quantities which should be administered, in divided doses, in twenty-four hours. For a child of two years, grain $\frac{1}{6}$ (grain $\frac{1}{72}$ every two hours); for a child of four years, grain $\frac{1}{4}$ (grain $\frac{1}{48}$ every two hours); for a child of six years, grain $\frac{1}{3}$ (grain $\frac{1}{36}$ every two hours); and for a child of ten years, grain $\frac{1}{2}$ (grain $\frac{1}{24}$ every two hours). Thus, if we employ the vehicle which Dr. Tappan used one-third of a century ago, the following prescription might be written for a child of six years:

R Hydrarg. chlor corros., gr. i;
 Alcoholis, f ss ;
 Elix. bismuthi et pepsini, f ss iv.
 Misce.

Dose, one teaspoonful every two hours.

According to the statement of physicians, considerably larger doses have been given with safety and apparent benefit, and in severe cases attended by profound blood-poisoning, such as Simon designates septic phlegmonous, certainly the maximum medicinal dose is required if we depend on the sublimate as the main remedy. Dr. Grant (Bey) administered to a child of four years one-half grain every half-hour till six doses were taken, and then hourly during the first day, every second hour on the second day, and on subsequent days at longer intervals. Dr. A. Jacobi states that an infant one year old may take one-half grain every day for many days in succession, with very little, if any, intestinal disorder, and with no stomatitis. Although certain children may tolerate doses so large as those recommended by Dr. Grant (Bey), safer doses are those which we have recommended above, and they seem to be sufficient for protracted use. Dr. P. Werner¹ recommends, in the treatment of diphtheria, the sublimate dissolved in distilled water in half-hourly doses, or at a little longer intervals, so that the following quantities are taken in twenty-four hours. For an infant of one and a half years, 0.015 (grain 0.231) of the sublimate in 120.0 (4 fl. oz.) of water; for a child at the age of six to seven years, 0.3 in 180 (grain 0.45 to 6 oz.) of water. This quantity is given in divided doses in the twenty-four hours. At night, if the child sleep, the doses should be less frequent and proportionately larger than in the daytime.

Those who discard the use of mercurials in diphtheria, like Jules Simon, in France, and one at least of our distinguished American writers,—group-

¹ St. Petersburger Medicinische Wochenschrift, 1886.

ing together calomel, the oleate, the unguentum, the cyanide, the biniodide, and corrosive sublimate, condemning them in a body on the ground that they enfeeble the system,—do injustice to the therapeutic virtues of the sublimate. Medicines having the same base often differ widely in their action upon the system; and it is the common, and probably correct, belief that the sublimate, in safe medicinal doses, does not enfeeble the system, but in some instances acts rather as a tonic.

In my practice, before the employment of the peroxide of hydrogen, good results apparently occurred from the local use of corrosive sublimate,—its use in the atomizer. If it be administered internally at the same time, care must be taken not to employ too much. The solution which I have employed in the atomizer consists of two grains of the sublimate to one pint of water; and in spraying the fauces every hour to two hours the bulb of the atomizer was compressed from three to five times. In ordinary cases I have used the spray every second hour. Oatman, of Nyack, New York, lost but one patient in twenty-three by the following treatment. Cotton was firmly wound around the end of a stick about the size of a lead-pencil, being drawn out as it was wound and made to project beyond the end. This was dipped into the solution of the bichloride of mercury two grains to the pint (1 to 3840), and passed into the throat until it touched the posterior wall of the pharynx. It was then instantly withdrawn and burnt. This treatment was repeated hourly with a new swab each time, until the inflammation began to subside, which was usually in forty-eight hours. Julius Stumpf treated thirty-one cases, with two deaths, by inhalation of the sublimate, using the apparatus of Richardson. For infants under the age of two years he employed 1 part to 4000; from five to six years, 1 part to 2000; for those over six years, 1 part to 1000. Dr. Thomas Welcher also recommends a solution of corrosive sublimate, 1 part to 1000, used as a gargle or as a spray. In most instances when this local treatment had been employed a few times, at intervals of one or two hours, he states that the pharyngeal disease began to abate and the general condition improved. He also employed small doses of the sublimate internally. It is evident from the experience of other physicians that when this agent is used as a spray in so strong a solution as 1 part to 1000, it should be used with caution. Two or three compressions of the bulb will be sufficient. Professor A. Jacobi recommends for washing the nares a solution of corrosive sublimate of from 1 part to 2000 to 1 part to 10,000, with or without 10 to 50 parts of table-salt or 60 to 300 parts of boracic acid.

The medical journals during the last few years contain abundant testimony like the above to the beneficial results of both the internal and the local use of corrosive sublimate in diphtheria. How to use this active agent internally and locally at the same time, without administering too large a quantity, is an important question for consideration. Some physicians administer the amount that can be safely employed in twenty-four hours, dissolved in water, and in frequent doses (every hour or second hour), and

if no drinks be given subsequently for a few minutes the local effect upon the fauces is to a considerable extent obtained. Perhaps this is the best and safest mode of employing this efficient and useful antiseptic agent in the treatment of diphtheria.

Calomel.—Some physicians begin the treatment of diphtheria with a single laxative dose of calomel. It is said that Dr. Coester prescribed it in the preliminary treatment of sixty-nine cases and lost only one.¹ Professor Simon, of Paris, discards in the treatment of diphtheria (1) blisters, which are followed by the reproduction of pseudo-membrane, (2) bleeding and mercurials, which enfeeble the patient, (3) preparations of opium, which produce rapid depression of the vital powers, and (4) potassium chlorate in large doses. The reference of Simon to mercurials is probably more particularly to calomel.²

On the other hand, not a few physicians regard calomel as a useful remedy in diphtheria. The editor of the *Therapeutic Gazette* writes, "We have so frequently seen an apparently severe attack of diphtheria abruptly aborted in its inception under the influence of large doses of calomel that we can scarcely believe that the drug has no pronounced effect. A grain of it should be put dry in the mouth of the child every hour or two until frequent very loose liquid evacuations are produced." George B. Fowler, Physician to the New York Infant Asylum, also regards calomel as a useful remedy, and when croupy symptoms occur he increases the dose from grain one-sixth to grain one-third or even to one grain hourly. Dr. William H. Daly, Chairman of the Laryngological Section of the Ninth International Medical Congress, administers two to five grains of calomel to a diphtheritic patient every one, two, or three hours until free catharsis occurs, and then at longer intervals, but so that three or four daily evacuations are produced.

Other physicians of ample experience in addition to those mentioned have recommended calomel in the treatment of diphtheria, some in laxative doses and only at the beginning of the attack, and others in doses of the fractional part of a grain every two to four hours during the sickness. But the majority of physicians—very properly, in my opinion—discourage the employment of calomel in laxative doses, believing that it tends to weaken the patient and increase the anæmia which in all cases of severe diphtheria soon becomes very manifest, whatever the treatment; but a single laxative dose is perhaps sometimes useful. It may do good, as in other infectious diseases, to unload the *primæ viæ* in the commencement of the attack, so that the remedies to be employed are more readily absorbed and without alteration by admixture with chemical products in the intestinal tract. What change calomel undergoes so that it can be absorbed has not been clearly ascertained. But the safest and in my opinion the most

¹ New York Medical Record.

² Journal de Médecine de Paris.

efficient mode of employing calomel is by its sublimation by heat and the inhalation of the vapor produced, which is pungent and irritating, but highly antiseptic. I have repeatedly observed its beneficial action when thus employed in diphtheritic croup. The patient is placed in a tent made by two sheets upon four upright posts, and made to inhale the vapor of fifteen to thirty grains of calomel placed upon a tin and sublimated by the heat of a spirit-lamp underneath, from fifteen to thirty minutes. This may be repeated every third or fourth hour when the inflammation has invaded the larynx and symptoms of laryngeal stenosis begin to appear. This is a powerful remedy, sometimes salivating the nurses, and it should be used no more frequently than the exigencies of the case demand.

Turpentine.—Among the recent remedies recommended by physicians of experience for its supposed action in arresting the formation and extension of the pseudo-membrane, and as an antidote to the diphtheritic virus, turpentine should be noticed. Dr. Rewentaver states that an infant of two years treated by other remedies began to have symptoms indicating invasion of the larynx on the fourth day. Tracheotomy was resolved upon, but previous trial was made of pure turpentine in a teaspoonful dose. The croupiness ceased, other symptoms improved, and the patient recovered without tracheotomy.

Schenker employed a mixture of coal-tar and turpentine, which was burnt in the room occupied by the patient, either constantly or several times during the day. His observations led him to believe that the benefit from this treatment resulted chiefly from the turpentine, and largely from its general effect on the system. He therefore decided to employ turpentine internally in doses of ten minims to one teaspoonful one to three times daily in milk, sugar-water, or gruel. At the same time he employed it as a spray. Alcoholic stimulation, cleanliness, and a diet of beef-tea, milk, and egg were also directed. Of thirty-six cases which Dr. Schenker treated by turpentine, thirty-one recovered.

Röse, of Hamburg, prescribed turpentine in teaspoonful doses, mixed with spirit of ether (ether one part, alcohol three parts), three times daily. A teaspoonful of a two-per-cent. solution of salicylate of sodium was also given every two hours. Under this treatment the temperature and pulse diminished, other symptoms improved, and in fifty-eight cases thus treated ninety-five per cent. recovered.¹ Sigel also prescribed turpentine in teaspoonful doses in forty-seven cases, in fourteen of which the question of tracheotomy had arisen. A manifest reduction of temperature followed the use of the turpentine. The percentage of deaths in those treated by the turpentine was 14.9, while of those treated by corrosive sublimate, salicylic acid, potassium chlorate, etc., 32.5 per cent. died. Dr. Llewellyn Eliot also reports good results from the vaporization of turpentine.

The recent recommendation of turpentine in the treatment of diph-

¹ *Therapeutische Monatsschrift.*

theria by physicians of experience and sound judgment has extended and established its use. Its efficacy depends on the fact that it is antiseptic and germicidal, and that when vaporized and inhaled, or taken by the stomach, it penetrates all parts of the system. The descriptions long given in the text-books of the physiological action of turpentine have had the effect to induce physicians to employ it in small doses. But I am not aware that any writer has recorded ill effects from the use of turpentine in diphtheria, although it has been employed by a considerable number of physicians in quantities which exceed the medicinal doses mentioned in the text-books.

It is well known that the constitutional effects of the oleum terebinthinæ, even to impaired vision, strangury, and bloody urine, may be obtained by the prolonged inhalation of its vapor.¹ The constant simmering or vaporization of the oil of turpentine with carbolic acid and oil of eucalyptus in water, in the sick-room, as recommended in the foregoing pages, is an eligible mode of employing this agent.

Pilocarpine.—Pilocarpine has been recommended by certain physicians in the treatment of diphtheria, in the belief that the salivary and mucous secretions which it produces aid in throwing off the pseudo-membrane and in preventing its formation. Dr. Lax² states that of ten patients treated by him with pilocarpine, some of them severely ill, all recovered. He employed the following prescription :

R Pilocarpini hydrochlorat., gr. $\frac{1}{4}$ ad $\frac{3}{4}$;
Acidi hydrochlorici, gtt. ii ad iii ;
Pepsini, gr. x ad xii ;
Aquæ destillat., fʒ xviiss.

Misce.

Dose, one teaspoonful to one tablespoonful, according to the age, in wine.

During less than two years Guttmann treated eighty-one cases with this remedy, without a death. Gelsner and Delewsky also report good results. On the other hand, I have seen the most disastrous effects from the use of pilocarpine in diphtheria, on account of the bronchorrhœa which it caused. The secretions filled the bronchial tubes, causing great dyspnœa, and, being expectorated with difficulty and insufficiently, death resulted. The symptoms which occurred were like those in extreme œdema of the lungs. I cannot, therefore, recommend its use. Its employment seems too hazardous, especially in young and feeble children.

Such are the more important internal remedies which have been employed up to the present time in the treatment of diphtheria. The number is large, and many others might be mentioned which are recommended by apparently good observers and are probably useful in certain cases. Diphtheria, being a disease of variable type, must be treated according to the

¹ Stillé and Maisch.

² Medical News.

indications in each case. Among the internal remedies which up to the present time have been most employed, and which appear to have the confidence of the profession to a great degree, we may mention the tincture of the chloride of iron, quinine, corrosive sublimate, turpentine, and the alcoholic preparations.

Among other remedies which have been recommended by experienced observers, the following may be mentioned. Dr. I. N. Love recommends sodium benzoate in five-, ten-, or fifteen-grain doses.¹ He remarks that Salkowski in 1879 noticed that this drug increased the secretion by the kidneys of nitrogenous and sulphurous compounds, and concluded that it would aid in depurating the blood of noxious matters. He states that Fleck and Buckholtz ascertained that the benzoate arrested the growth of micro-organisms in putrid liquids, and Graham Brown that diphtheritic liquids became non-contagious by the addition of the benzoate. Helferich and Sanné, from experiments made on animals, also consider sodium benzoate to be destructive of the diphtheritic virus. On the other hand, M. Dumas has not derived any marked benefit from its use, and Dr. A. Jacobi states that it does not deserve the eulogies bestowed upon it from theoretical reasonings. In my opinion we have more efficient remedies, and it is not likely, therefore, to come into general use. Copaiba and cubebs are employed and recommended by certain French physicians. Jules Simon prescribes them for patients over the age of five or six years.² Dr. J. H. Fruitnight has employed sodium hyposulphite in eight cases, with a good result, giving hourly drachm doses of the following: \mathcal{R} Sodii hyposulphitis, \mathfrak{z} i; aquæ, $\mathfrak{f}\mathfrak{z}$ ii. Illingworth recommends biniodide of mercury; Dr. C. B. Galentine, hydrate of chloral given with potassium chlorate, in about two and one-half grain doses to a child of six years. H. L. Snow recommends sulphurous acid, and S. S. Smith oil of eucalyptus and Warburg's tincture; and the list might be largely increased.

Albuminuria.—This being due to septic nephritis, patients have seemed to me to be more benefited by the tincture of the chloride of iron in frequent and rather large doses than by any other remedy. If while this is being used a marked diminution of urine occurs, it may be necessary to employ diuretics and laxatives as in scarlatinous nephritis. The following prescription may be employed:

\mathcal{R} Potassii acetatis,
Potassii bicarbonatis,
Potassii citratis, \mathfrak{aa} \mathfrak{z} ii;
Infus. tritici repentis, $\mathfrak{f}\mathfrak{z}$ viii.
Misce.

Dose, one teaspoonful every three or four hours to a child of eight years.

But marked diminution of the urine, and especially anuria, occurring in

¹ Weekly Medical Review.

² Le Progrès Médical.

diphtheria, usually ends fatally, according to my observations, whatever the treatment.

Paralysis.—The loss of the tendon reflexes, and palatal and multiple paralyses, require the same stimulating and sustaining remedies that are appropriate for the primary disease diphtheria. Iron and other tonics, nutritious and predigested or easily-digested diet, and massage, aided in some instances by the galvanic current, suffice to restore the use of the affected muscles; but sometimes weeks and even months elapse before this is fully effected. So long as the paralysis does not affect any vital organ, the prognosis is favorable, although recovery may be slow.

On the other hand, it is evident from its nature, and the cases reported in the literature of diphtheria, that cardiac paralysis is exceedingly dangerous, and must be treated promptly and by the most active remedies, or death results. The attack of cardiac paralysis is usually sudden, with little forewarning, or a forewarning that is likely to be overlooked, and in not a few instances is fatal before the physician promptly summoned is able to arrive. The patient should be as quiet as possible in bed, with the head low, and alcoholic stimulants should be administered at once. In the sudden attacks of heart-failure hypodermic injections of brandy act most promptly in sustaining the heart's action. Ammonia, camphor, musk, and the electrical current may be useful auxiliaries. The predigested beef preparations, peptonized milk, and other concentrated foods designed for those with feeble digestion, are useful. If the urgent symptoms are relieved by these measures, such remedies should be employed as are useful in other forms of diphtheritic paralysis. The patient is ordinarily feeble, anæmic, and with poor digestion. Peptonized or easily-digested and concentrated foods should be prescribed, together with iron, quinine, and alcoholic stimulants. The use of the electric current is suggested by the nature of the attack. Many physicians believe that they have obtained benefit from it in the treatment of the more common forms of diphtheritic paralysis, while others speak doubtfully of its efficacy. If there be reason from the symptoms to suspect the presence of central lesions in the nervous system, the galvanic current in short sittings has been recommended, and not the faradic. In ordinary cases either the direct or the induced current may be employed.

Strychnine is, however, regarded by good observers as the most efficacious nerve-stimulant in the various forms of diphtheritic paralysis. Oertel's objection expressed twenty years ago to the use of strychnine in this disease, that, acting as an excitant to the spinal cord, it is likely to aggravate central lesions, was founded on a wrong understanding of the pathology of the paralysis. Professor Henoch cured diphtheritic paralysis in three weeks by hypodermic injections of strychnine. W. Reinard¹ states that a boy three and a half years of age, fifteen days after the appearance of the diph-

¹ Deutsche Medicinische Wochenschrift, 1885, No. 19.

theritic patches on the tonsils had paralysis of the inferior extremities and the velum palati, a tottering gait, nasal voice, and difficult deglutition. At the end of twelve days death seemed imminent, the paresis of the lower extremities had become a complete paraplegia, and the paralysis of the upper extremities and of the muscles of the nucha, larynx, and thorax was complete. He was unable to sustain himself in a sitting posture, his head falling heavily on his chest. He had also dyspnea, hoarse cough, tracheal râles, and aphonia, probably from cardio-pulmonary paralysis. Reinard made a hypodermic injection each day of one milligramme (about one-sixty-sixth of a grain) of sulphate of strychnine in the nucha. Improvement began in twenty-four hours in the tonicity of the muscles. On the third day the cardiac and pulmonary paralysis had so improved that the tracheal râles had ceased. The respiration was more normal, and deglutition possible. On the fifteenth day of this treatment and after fifteen injections the patient was considered cured. Dr. Gerasimow relates the case of a child six years of age who had paralysis of the velum, pharynx, larynx, and lower extremities. Six weeks after the commencement of paralytic symptoms, subcutaneous injections of about one-thirty-first of a grain of strychnine were given daily. With this treatment the patient improved, and after seven injections of this strength, followed by twelve of one-twenty-second of a grain, the cure was complete.

With such strong testimony in favor of the use of strychnine in the treatment of diphtheritic paralysis it is perhaps remarkable that physicians of experience state that they have not observed any marked benefit from its use. At a meeting of the New York Clinical Society held December 23, 1887, Dr. Holt stated that he was yet to be convinced that strychnine possessed any specific value in this disease, though it was of much value as a general tonic. At the same meeting Dr. A. A. Smith stated his belief that tonics and time did more for diphtheritic paralysis than anything else. He had used electricity and strychnine, and had never been able to satisfy himself that electricity did any good, and the effects of strychnine seemed to him to be not specific but like those of a general tonic. On the other hand, Dr. Thacher, of New York, has reported a case in which the galvanic current was employed alternately on the two upper paralyzed extremities, on each for a week at a time. It was invariably found that the arm receiving the treatment gained more rapidly than the one not treated, the strength of the two limbs being tested by the dynamometer. The test seems to have been conclusive as showing the efficacy of galvanization.

THE SURGICAL TREATMENT OF CROUP AND DIPHTHERIA.

BY CHARLES B. NANCREDE, M.D.,

Professor of Surgery and of Clinical Surgery in the University of Michigan,
Ann Arbor, Michigan.

THE indications for or against operative interference must be sought in the articles on croup and diphtheria, because this section deals only with the necessary instruments for, and the technique of, intubation, tracheotomy, etc.

INTUBATION.

This operation is one whereby the dyspnoea caused by acute laryngeal stenosis is relieved by the introduction into the larynx and retention there of a specially-constructed metallic tube, which mechanically prevents closure of the chink of the glottis, either by inflammatory swelling, membranous accretions, or spasm of the adductor muscles.

The operation as at present employed is the result of the experiments of Dr. J. O'Dwyer, of New York, commenced in 1880, although, unknown to him, Bouchut, of Paris, in 1858 had successfully employed intubation in a few instances, so far as concerned the facts of the tolerance of the larynx for a metallic tube and the relief of dyspnoea thereby afforded, but no recoveries resulted. Space forbids any description of the transition stages

FIG. 1.



Introducing instrument and obturators.

through which the instruments and the operation passed before reaching their present forms.

Instruments.—These consist of a mouth-gag, an introducing instrument, various-sized tubes and a gauge for these, an extracting instrument, open-

ended rubber finger-stalls to protect the operator's fingers, and, possibly, a respirator to cover the operator's mouth and nose.

Tube.—The upper enlarged extremity forms a head, or collar, which rests upon the false vocal cords. (Fig. 1, *b*.) It is diamond-shaped, all the angles being rounded, but the anterior specially reduced and bevelled until this and the adjacent margins present almost a curve, with smoothly-rounded borders, well adapted to allow closure of the epiglottis over the tube, while the opposite, prolonged, rounded angle rests between the arytenoid cartilages; the plane of the upper surface forms an angle of about sixty-seven degrees with the long axis of the tube. The rounded surfaces which join the head to the tube form an irregular pyramid, whose apex is placed at the posterior edge of the tube, which is compressed at the point of junction to its smallest transverse diameter, to obviate pressure upon the true vocal cords. Below this point the tube gradually increases in its transverse diameter—by thickening of its walls—to the mid-point, when it again tapers to a laterally compressed ovoid: this central bulging tends to hold the tube in position both by its shape and by the additional weight. The anterior margin of the lower extremity should present a thick, carefully-rounded edge, because during deglutition this portion moves comparatively freely over the adjacent mucous membrane and may produce ulceration of this, even to baring of the tracheal rings. A small perforation through one side of the collar is provided, through which is to be passed a long, fine, *braided* silk ligature, which, tied into a loop, will serve to remove the tube if the latter be slipped into the œsophagus instead of the larynx or if it become suddenly blocked with membrane: braided silk is to be preferred to the twisted, which may either fray out or not run smoothly through the perforation, thus probably pulling the tube out.

The gauge (Fig. 2) serves to indicate the proper tube to be employed at any given age, from five to six tubes usually forming a set suited to ages from one year to puberty. Fitting each tube is a jointed, blunt-ended obturator, to be screwed to the introducing instrument (see Fig. 1, *a*), which consists of a handle with sliding button, a staff, curved at its extremity, with a screw-thread for attachment of the obturator, and a trigger connected with a sliding collar,—partly flexible,—which, projected by pressing upon the button, disengages the obturator by holding the tube down with two lateral projecting arms while the former is so loosened as to be readily withdrawn.

The gag, locking when *in situ*, is designed to be placed between the back left molar teeth, with its handles directed backward toward the ear. (Fig. 3.) The extracting instrument consists of a long-handled staff, curved to a right angle, terminating in short-jawed, duck-bill-bladed forceps, which, being serrated upon their exterior, when introduced *within the lumen of the*

FIG. 2.

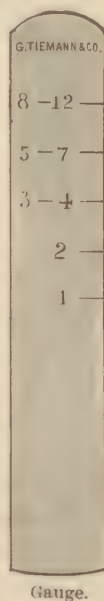


FIG. 3.



Gag.

tube can be separated by pressing upon a lever so that the tube can be withdrawn. (Fig. 4.) The gauge gives the size of the tube to be employed at any age up to twelve years.

Operation.—First examine whether the tube is readily detachable when the trigger is pulled, and at the same time is securely enough held to allow of its being placed in position. The largest tube that the larynx can com-

FIG. 4.



Extracting instrument.

fortably admit had better be introduced, thus giving both freer access of air and egress for mucus and fragments of membrane, while the instrument itself is less likely to become displaced.

The nurse or an assistant must hold the child upright upon the lap, having first secured the arms to the sides and the limbs together by firmly rolling the patient in a blanket from the shoulders down, carefully avoiding the formation of folds beneath the chin, which would interfere with proper access to the opened mouth. Still further to secure fixation, the nurse must grasp with her hands the child's elbows, firmly holding them down against the thorax, but avoiding pressure upon it, lest the already embarrassed respiration be further interfered with, while at the same time the legs are held between her knees. Finally, the head must be fixed by a second intelligent assistant, standing behind the nurse, by applying the opened hands over the child's cheeks and ears. These directions must be strictly followed out, and in the order named: "the position of the child should be as though it hung from the top of its head,"¹ and this position must be maintained throughout by the nurse retaining the lower limbs between her own knees

¹ Northrup, *Cyclopaedia of Diseases of Children*, i. 534.

and keeping the child's thorax firmly against her own, while the second assistant immovably maintains the head in its upright position, as if he were trying to lift the patient directly upwards and keep it suspended by the head.

Thus secured, now place the mouth-gag between the molar teeth of the left side, separate the handles, and secure them so as to fix open the mouth, directing an assistant to steady the instrument by the levers so that it may not become displaced. The operator may either stand, or, perhaps better, sit on a chair, opposite the patient, with his left forefinger covered with an open-ended rubber finger-stall: this prevents laceration of the finger if the gag becomes displaced. Introducing the forefinger thus guarded into the pharynx until the epiglottis is reached, this must be hooked up, and the finger carried to one side of this organ, which is to be held up by pressure on its edge. The tube, mounted on its obturator and attached to the inserting instrument, with the thread loop clear and running freely, is now to be passed by the right hand to the end of the left forefinger, carefully maintaining the instrument strictly in the median line and with the handle well depressed upon the patient's breast. By elevating the handle the extremity of the tube enters the larynx, and slips into place; the left forefinger steadies it by pressure upon the collar, while the trigger is pressed and the obturator removed by depressing the handle: finally, the left forefinger-tip, which has been employed to steady the tube while disconnecting it, should press the head of the tube well down into the larynx. It is better to leave the thread loop for half an hour, or even longer, carefully secured, so as to avoid entanglement, by tying it to a second thread passed around the neck, because, if the breathing becomes more embarrassed after the tube is fairly settled in place and the efforts at respiration upon the child's part do not promptly free the tube of mucus and fragments of membrane, the instrument is certainly blocked with false membrane pushed ahead of it or impacted in its lumen, and must be instantly removed; although the temporary retention of the thread is provocative of coughing and retching, this is rather beneficial than otherwise, serving to clear the air-passages of mucus and membrane: if removal of the tube does not afford relief, tracheotomy must be promptly performed, for which reason tracheotomy instruments must *always* be available when intubating. When respiration becomes easy, the gag must be reintroduced, the tube steadied by the left forefinger, and the thread carefully withdrawn; this completes the operation. And now as much sleep as possible must be secured, giving, after some rest has been obtained, very small quantities of milk or cracked ice, until the patient learns to swallow. Should the first attempt to introduce the tube fail,—taking probably about a minute,—a few moments' rest must be allowed, after which a second effort should be made. If the patient seems much exhausted by the first attempt, the gag had better be removed for a short time, when the whole procedure, as above described, must be repeated.

Removal of the Tube.—The position recommended for introducing the

tube is probably the best, although the head may sometimes be slightly bent forward. Whether the tube is to be removed to clear it of tenacious mucus or membrane,—which sometimes becomes requisite,—or to ascertain whether its further use cannot be dispensed with, another tube, attached to the introducing instrument, with its loop of thread carefully arranged, must be ready for instant use. If a second instrument is not at hand, the tube just removed may be utilized, if suffocation seems imminent, by following Northrup's advice, which is to clear its calibre, "thrust the obturator into the tube, and take two turns of thread of any kind around the neck of the tube, gathering the two ends in the right hand as it grasps the handle. In this way the thread holds the tube to the obturator during insertion, and, when it is in the larynx, unwinds from the shaft, and is drawn away."¹

After-Treatment.—In from two to four hours—because then the larynx has usually become accustomed to the tube, and irritation has ceased—the attempt to administer liquid nourishment should be made. Patients old enough may be allowed to drink freely from the cup. Although this usually results in violent coughing, most of the fluid is swallowed, while the coughing clears the larynx of that which enters it: again, some patients can take liquids better by the teaspoonful, lying upon the back or one side, in the former position the milk passing along the back of the pharynx, in the latter passing to one side, thus escaping the orifice of the tube. Semi-solid foods, as thick custards, thick corn-starch or oat-meal, soft-boiled eggs, etc., are oftentimes more readily swallowed than fluids. Cases have been reported where milk could readily be taken by means of the ordinary nursing-bottle; others require elevation of the foot of the bed to forty-five degrees; while in some instances the child will decline any food, in which case rectal alimentation becomes the only resort.² This measure should also be occasionally resorted to whenever the attendant believes that insufficient nourishment is being taken by the mouth, or to give the child an occasional rest from the fatigue of taking food by the mouth. Tracheotomy may have to be done if it becomes impossible adequately to nourish the patient.

Temporary Removal of the Tube.—When such a stimulant as a mouthful of equal parts of whiskey and water will not enable the child to clear its throat of thick mucus, the tube may require removal, when either free respiration will persist for a variable time up to some hours or longer, or, from collapse of the parietic vocal cords or the swollen condition of the tissues, immediate dyspnœa will supervene, requiring a prompt reintroduction of the tube; again, the dyspnœa may gradually or suddenly recur, requiring a second employment of the tube even so late as forty-eight hours after its removal: so that in all cases, while the tube when removed for any cause should be left out as long as possible, surgical aid should

¹ Op. cit., p. 526.

² Forced stomach-feeding with catheter and attached funnel and tubing may be tried, as described farther on.

always be easily accessible for the next few hours afterwards, and everything should be in readiness for intubation.

Reinsertion.—The rule given in the following words is probably the best: "Intubation should be performed as soon as air ceases to enter the posterior inferior lobules of the lungs,"¹ as shown by auscultation.

Estimation of Value, Mortality, etc.—Waxham's statistics of 1888 give a percentage of recovery of 26.27, which is about the same as that of tracheotomy. Intubation is probably a more successful operation under four years, especially with the deep, fat neck of children of that age; it does not require the knife or anæsthesia, therefore permission for its performance is easier to gain; shock is slight, and the inspired air is filtered, warmed, and moistened. Intubation is preferable where the proper care of the tube cannot be secured. It must be remembered that many of the milder cases are intubated which formerly recovered without tracheotomy and where this operation would never have been urged. Finally, the trachea has to be opened more frequently than the enthusiastic advocates of intubation are willing to admit, because (1) of the impossibility of keeping the tube in position, (2) of the difficulty of nourishing the child, and (3) even when properly introduced failure to afford relief to respiration obtains; again, if suddenly blocked with membrane death must result unless the tube is coughed up or the trachea opened; (4) it is not an easy operation except to an expert, especially in patients under three years or between twelve and fourteen; indeed, whenever the epiglottis and envioning tissues are much swollen, tracheotomy is the easier operation; intubation requires at least two good assistants, while tracheotomy can at a pinch be done with one. The rapid respiration—sixty to eighty to the minute—occasionally observed is not due to the inadequate calibre of the tube, but to bronchial croup or broncho-pneumonia.

The objection urged against tracheotomy that diphtheria of the wound is of very common occurrence, is a mistake; sepsis has commonly another source than the wound, and is operative before the trachea has been opened; ulceration of the trachea occurs after intubation as after tracheotomy, although probably it is not of such frequent occurrence.

Tracheotomy should be done where intubation is impossible or fails to give relief to the dyspnoea. Thus, it is preferable in severe cases of croup, when only ordinary assistance can be obtained, since any one can cut the tapes and remove the canula if occluded and keep the tracheotomy-wound open until assistance arrives, while the intubated case under similar circumstances can be relieved only by skilled hands, and the patient must die unless able to free the tube unaided or cough it up. When nourishing the case is difficult or impossible, or when the tube requires frequent replacement because coughed up or from becoming gummed, tracheotomy is the better operation.

¹ Northrup, op. cit., p. 537.

TRACHEOTOMY.

Tracheotomy for croup is that operation by which the dyspnoea induced by laryngeal stenosis is relieved by an opening made in the trachea and mechanically kept more or less permanently patent: when the incision traverses the cricoid cartilage as well as the upper tracheal rings, the operation is termed *laryngo-tracheotomy*, an incision sometimes intentionally or unintentionally adopted when attempting a high tracheotomy.

Although this operation was advised and performed by Asclepiades of Bithynia a century before our era, its general adoption in modern times is owing to the labors of Barthez, Guersant, and above all of Trousseau.

Without any desire to magnify the risks and difficulties, it is well to remember that while in many cases the operation proves to be surprisingly easy, yet in children especially it may be a most difficult and embarrassing one to perform, owing to the shortness of the neck, the large relative size of the thyroid isthmus, the presence, possibly, of the thymus gland, the large distended veins of the parts, the abnormal course pursued by the large vessels of the neck, which occasionally cross the line of the incision, and the amount of adipose tissue rendering the depth of the trachea from the surface very great.

Coolness and promptitude in meeting emergencies, rather than rapidity, are requisite, for it is rare indeed that time does not suffice to take each step of the operation with deliberation, thus really saving time during the latter, more important stages, since in nearly every case the obstruction has been gradually induced, and considerable time will elapse before fatal carbonic-acid poisoning of the blood can result, unless a sudden, persisting spasm of the larynx occurs.

As each stage of the operation is described, such points of the surgical anatomy as are essential will be detailed; but for fuller information the reader is referred to the excellent monograph of Dr. L. S. Pilcher, of Brooklyn, New York, in the *Annals of Anatomy and Surgery* for April, 1881, or to Gill's *Sanné on Diphtheria, Croup, and Tracheotomy*.

SURGICAL ANATOMY OF THE PRETRACHEAL SPACE.

Deep Pretracheal Fascia.—This consists of two layers blended above where attached to the hyoid bone, dividing on either side to enclose the sterno-mastoid muscles, but separating again into two distinct layers midway between the cricoid cartilage and the sternum, the intervening space being occupied by fatty areolar tissue; the superficial layer is attached to the anterior border of the sternum, the other to the posterior border of the same bone. It is important to remember this arrangement of the fascia which covers in the sterno-hyoid and sterno-thyroid muscles, that when operating both layers may be nicked and slit up, instead of only the anterior, this error leading to delay by puzzling the operator as to the anatomical relation of the deeper parts. A deeper process of the cervical fascia encloses be-

tween two layers the thyroid body, with its isthmus, vessels, etc. These layers coalescing above are attached to the cricoid cartilage, so that a transverse incision at this level will enable the operator readily to strip down the gland, isthmus, and vessels, thus exposing the upper rings of the trachea without any possibility of wounding anything but a few superficial veins.

Veins.—These assume especial importance from the fact that during embarrassed respiration from any cause they become greatly distended, giving rise to serious hemorrhage if wounded; they are also most irregular in their distribution. The most common arrangement is that the anterior jugulars form two parallel trunks running down upon either side of the median line connected superiorly by one transverse branch, and just above the sternum by a second which passes beneath the deep fascia; a single median trunk is the next most common variation, while the absence of one lateral trunk is sometimes compensated for by an oblique branch crossing from the external jugular above, downwards to the lateral anterior jugular of the opposite side. Deeper, a venous plexus surrounds the thyroid isthmus emptying into the superior and inferior thyroid veins. Very rarely the left innominate vein passes high enough above the sternum to be seen and possibly wounded during a low tracheotomy. Although any of the great vessels, including the subclavian and the innominate, may cross the trachea at the point usually incised, thereby demonstrating the advisability of deliberate operating, practically the crico-thyroid is the only normally-placed vessel which is endangered; but the possible presence of a thyroidea ima must not be forgotten. The former is usually so small that it can be ignored, but it occasionally gives rise to considerable hemorrhage when divided; moreover, the superior thyroid may pass down across the crico-thyroid space to give large branches to the thyroid isthmus, while the inferior thyroid may cross the trachea below in the line of the incision. The thyroidea ima is found once in every ten bodies dissected.

Muscles.—Only the sterno-hyoid and sterno-thyroid muscles are of special interest here, because, while nearly, if not quite, in contact above, they diverge below, and the median space between is that through which the trachea must be reached.

Thyroid Gland.—The isthmus chiefly concerns the surgeon owing to its variable size and vascularity, for, although sometimes its division causes only trifling bleeding, occasionally quite large vessels run along its borders, giving rise, if divided, to free hemorrhage at one of the most critical stages of the operation: again, more than once, severe secondary hemorrhage has been reported following division of the isthmus, which commonly lies only over the second and third tracheal rings, but may extend so far upwards as to cover the cricoid cartilage.

Thymus.—This structure has been reported as persisting so as to embarrass the operator even as late as until fifteen months of age, filling in the lower part of the incision.

Trachea.—Commencing at the inferior border of the cricoid cartilage, only that portion above the sternum is concerned in tracheotomy. Its loose connection by cellular tissue to the circumjacent parts, allowing of its ready displacement by pressure, is of importance, because the weight of two pairs of hemostatic forceps attached to each margin of the fascia which has been torn off the front of the trachea will, if each is allowed to drop outwards, lift the windpipe up so as to render it comparatively superficial. Although the trachea is near the surface at its junction with the cricoid cartilage, at the point opened in low tracheotomy it is more deeply seated than is usually recognized.

The *thyroid cartilage* is so slightly developed in children that its upper margin lies behind the hyoid bone, rendering it difficult of detection. Fortunately, with but few exceptions, the cricoid cartilage can be readily outlined. The small size of the larynx persists until puberty, so that the cricoid cartilage is placed relatively high in children. According to Tillaux, the distance between the cricoid cartilage and the sternum is: between two and three years, three and a half millimetres; between three and six years, four millimetres; between six and ten years, five millimetres. In adults the distance varies from four and a half millimetres to eight and a half millimetres, in twenty-four specimens averaging six and a half millimetres.¹

The following table gives the diameter of the trachea and that of the outside tubes which can be worn at given ages:

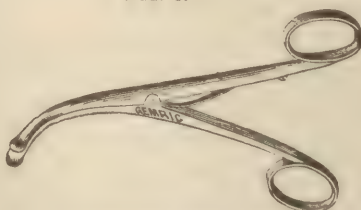
Age.			Variations.	
			Millimetres.	Inch.
1½ to 2 years	.	.	between 6—8	= ¼—⅓
2 to 4 "	.	.	" 8—10	= ⅓—⅔
4 to 10 "	.	.	" 10—12	= ⅔—1
10 to 20 "	.	.	" 12—19	= 1—1½

"As a rule, all ages up to three years can wear a tube one-fourth of an inch in *outside* diameter,—six millimetres; of course, over two years, a little larger."²

Instruments.—Although in an emergency the only instrument absolutely



Golding-Bird's tracheal dilator.



Trousseau's tracheal dilator.

necessary for tracheotomy is a knife, yet, when possible, the following instruments should be provided: one small narrow-bladed scalpel, a grooved

¹ Gill's Sanné, p. 23.

² Ibid., p. 32.

director, one tenaculum, two aneurism needles, a pair of retractors, one pair of dissecting forceps, several pairs of hemostatic forceps, one pair of scissors, one sharp-pointed tenotome, one blunt-pointed tenotome, one pair of tracheal forceps, one tracheal dilator, several tracheotomy tubes with tapes, a large curved needle armed with a stout ligature, a flexible catheter, ligatures, sponges, feathers, and several large hair-pins, bent to form retractors.

With the exception of the tracheal tubes, the figures explain the instruments sufficiently.

Tracheotomy Tubes.—To avoid unnecessary movement, which tends to produce ulceration almost as readily as does undue pressure, the tube should be as large as the trachea will comfortably accommodate: it is, therefore, requisite to have several sizes of these instruments ready. All tubes must allow the tracheal portion of the instrument—the outer tube—to move freely in the collar to which the tapes are attached; the inner tube should fit the outer accurately and should be somewhat longer,—about one-sixteenth of an inch,—to insure that all inspissated mucus, etc., be cleaned out and pushed off the extremity of the outer tube when the inner one is reintroduced; the outer tube should *not be fenestrated*.

Canulæ should be constructed with the minimum of tapering consistent with the easy introduction and, at the same time, accurate fit of the inner tube; while the ideal tube is one bent at an obtuse or even a right angle,—which latter form is, indeed, the only proper one for permanent wear. The mechanical difficulties in the construction of an inner tube which can be readily introduced are such that the quarter-circle metallic one is that commonly employed, and, upon the whole, it gives satisfaction. Solid obturators are decidedly objectionable, a fenestrated one being (Fig. 7) preferable if any be employed, but they are unnecessary when a tracheal dilator is used, and they add somewhat to the risk of stripping off and packing of false membrane into the trachea. Although no fixed rule can be given concerning the size of the tube to be employed, beyond that it should fit the trachea rather snugly, the table given on page 398 will prove serviceable for the inexperienced. While it is advisable to use as large a tube as can be comfortably borne to render the exit of membrane and thick mucus easier, it must not be forgotten that the area of the glottis is far less than that of the cricoid cartilage, so that if only a smaller tube is available than the size of the trachea would indicate as possible of introduction, no anxiety need be felt as to the access to the lungs of sufficient air.¹

Shall anaesthesia be employed? is a question difficult to answer on paper,

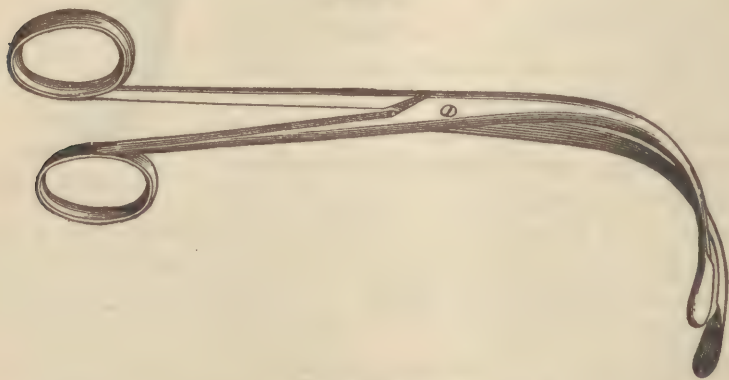


FIG. 7.
Fenestrated obturator.

¹ Hard rubber canulæ require to be so thick that the lumen is too much reduced. Aluminium tubes may be employed instead of silver, but their only advantage is lightness, and they must not be immersed in or even touched with bichloride of mercury solution.

but in practice hard to answer only by the tyro. In those cases where most dangerous,—in fact, inadmissible,—those where the advanced cyanosis indicates the danger of further diminishing the already inadequate supply of oxygen, and rendering still more obtuse the respiratory centre, whose sensibility is already so blunted as to require but little more to cause arrest of function, *there is no need for it, because the pain of the knife is almost if not entirely unfelt, certainly after the skin has been incised.* When an early operation can be done, when in consequence sensibility is little or not at all obtunded, while unnecessary if competent assistants are obtainable, if used with judgment, anæsthetics certainly render tracheotomy easier. Chloroform should be administered rather than ether, the latter agent often at once setting up such spasm of the glottis and increased dyspnœa in those previously breathing with but little embarrassment that a hurried, and therefore a hazardous, opening of the trachea becomes imperative. In any event, as soon as the skin has been incised the anæsthetic should be dispensed with. Personally, the author is opposed to the use of an anæsthetic for tracheotomy, and has seldom resorted to one. Hewitt says that “fatal cyanosis is kept at bay not only by compensatory increase in the activity of the nerve-centres which preside over normal respiratory movements, but also by the co-operation of the centres which preside over muscles which take little or no share in ordinary breathing. During ordinary sleep the activity of the diaphragm is lessened, the centres which preside over it enjoying comparative rest;

FIG. 8.



Tracheal forceps.

while in obstructive dyspnœa the patient to a great extent depends upon increased action of the diaphragm, so that natural sleep is generally impossible except at short intervals. Those vicarious centres will certainly fall victims to an anæsthetic sooner than the automatic or superior centres. The anæsthetic will not, therefore, respect vicarious function, and the muscles will become paralyzed in the usual sequence, and the patients will become more embarrassed in their breathing, or the breathing will cease altogether.”¹

¹ London Practitioner, p. 99, 1887.

CHOICE OF OPERATION.

On account of the more superficial position of the trachea, the absence of important vascular structures liable to be wounded, and the equal efficiency as a therapeutic measure, the *high operation*—i.e., that where the trachea is incised above, or rather *beneath*, the isthmus of the thyroid gland—should be preferred to the *low operation*,—i.e., where the opening is made below the thyroid isthmus; although this latter operation is a better one when a foreign body has to be extracted or the tube worn permanently.

For either operation the patient should be placed upon the back, facing a good light, and, if not anæsthetized, the hands and lower extremities must be carefully held by one or more assistants. In order to render the deeply-situated trachea more accessible, a large bottle, or a rolling-pin wrapped in a towel, or a small, firm, rounded cushion, should be placed beneath the shoulders and back of the neck, so that the head is thrown into a position of forced extension, where it must be maintained by an assistant standing behind placing the palms of the hands and the extended fingers upon each side of the head and face.

High Operation.—Standing upon the right side of or behind the patient, according to the fancy of the operator, the surgeon, after locating the cricoid cartilage, should make a strictly median incision, dividing the skin for from two to two and a half inches, the mid-point corresponding to the cricoid cartilage. If the superficial anterior jugular vein now lies in the way, it must be pushed aside, divided between two ligatures, or clamped between two hemostatic forceps before division, according to the time at the disposal of the operator, and the fascia nicked and slit up on a director to the full extent of the skin-wound. Next the deep fascia must be incised in the same way, dealing with any large veins met with as already directed. Searching in the median line for the intermuscular space between the sterno-hyoid muscles above and the sterno-thyroid muscles below, these should be separated by the knife-handle or director and held aside by retractors *placed in position by the operator himself*, as the author has more than once seen the trachea laterally displaced, misleading the surgeon, while at the same time a dangerous amount of pressure may be made upon this flexible tube, completely occluding its lumen. The surgeon has been thus so much led astray that, as reported by both Durham and Marsh,¹ the dissection has been carried down between the great vessels and the trachea until the vertebræ have been reached before the error was detected. Exploration of the wound by the forefinger serves to locate the trachea and detect any aberrant vessels. The thyroid isthmus should be seen as soon as the muscles have been separated, sometimes filling the wound to such an extent that it must be pulled downwards by some blunt instrument, as an aneurism needle. A carefully-conducted transverse incision, about one-third to one-half inch long,² across

¹ Holmes's System of Surgery, second edition, vol. ii. p. 503.

² In older children or in adults this incision must be longer.

the upper border of the cricoid cartilage will divide the deep layer of the cervical fascia, which encloses the isthmus and thyroid body, so that all these structures can be readily stripped down from off the upper two or three tracheal rings by insinuating a director beneath them from above, aided perhaps by grasping the cut edge of the fascia with a pair of forceps. The only remaining covering of the trachea is a loose-meshed fascia, which must be carefully cleared from the windpipe by the director or knife-handle until the tracheal rings are fully exposed: sometimes this tracheal fascia requires a preliminary nicking with the knife before it can be separated by the director. During this or some earlier step of the operation it is not uncommon for a pronounced hissing sound to be heard, and even bubbles of air seen in the wound, suggestive of the entrance of air into a vein or of accidental opening of the trachea: this is due to the violent inspiratory efforts sucking air between the fascial planes as they are opened. The retractors had better be now readjusted to draw aside the deeper structures, so as fully to expose the trachea, and, if time permits, all hemorrhage should be arrested by pressure-forceps or ligature. Fixing the trachea with a tenaculum firmly thrust in a little to one side of the median line, with a sharp-pointed tenotome now deliberately incise the windpipe for three-eighths to one-half inch,¹ carefully avoiding transfixion of the trachea, an accident which has more than once occurred, even the œsophagus having been wounded by too bold a thrust, but, upon the other hand, introducing the instrument deep enough to insure *dividing the false membrane*, which must otherwise be pushed ahead of the canula, completely arresting the entrance of air, the nature of the accident rarely being detected in time to remove the obstruction with the tracheal forceps. The occasional difficulty experienced when attempting to incise the trachea with a dull knife, and this toughness of the false membrane, induce the author to advise the substitution of the tenotome for the scalpel used during the earlier stages. If the tracheal incision be not of sufficient size it can be most safely enlarged with the blunt-pointed tenotome, taking special precautions that by means of retractors, aneurism needles, etc., all veins be kept out of the way of the knife, since it hardly needs argument to prove that hemorrhage is specially dangerous at this point, as the blood will of necessity flow into the opened trachea: indeed, this very accident has occurred so often at this stage of an otherwise well-conducted operation, from neglect of the precautions mentioned, that this warning is far from unnecessary. As soon as the trachea has been opened, a paroxysm of coughing usually ensues, causing ejection of bloody mucus and fragments of false membrane: sponging this quickly away, the tracheal dilator should be introduced, its blades separated, and the tenaculum removed. No more delay than is absolutely necessary should elapse before the introduction of the dilator, since the tenaculum, if firmly held, interferes with and often stops respiration; but it renders the last

¹ In adolescents and adults the incision must be longer; in the very young not more than one-fourth inch.

steps of the operation so much easier, quicker, and therefore safer, that the majority of surgeons now employ it. It not uncommonly happens that at this stage the respiration ceases momentarily, to be resumed usually after clearing the trachea with forceps, feather, or catheter of all mucus, blood, etc., aided perhaps by artificial respiration. Great care should be exercised to clear the trachea by the above-mentioned means of all loose or partially-detached membrane and thick mucus. If respiration is not promptly resumed, instead of attempting the dangerous and futile measure of mouth-suction of the wound, an elastic catheter should be passed well down into the trachea, thus breaking through obstructing débris, and air be *blown* into the lungs, which, as Gay pointed out, will enable the next artificial or natural effort at expiration, by a *vis a tergo*, to clear the bronchi of obstruction, and that, too, by an agent supplying oxygen administered without any danger to the operator. Any form of aspiration is ineffectual, being founded on a wrong conception of the requirements of the case, and is usually most dangerous to the operator. It has been recommended in ordinary cases where respiration is easy after the dilator has been introduced to instil into the trachea, during the efforts to clear it of membrane, some alkaline solution, as sodium bicarbonate, alone, or combined with glycerin after Parker's formula :

R Sodii carbonatis, \mathfrak{Zi} - \mathfrak{Ziiss} ;
 Glycerini, \mathfrak{Zii} ;
 Aquæ, q. s. ut ft. mist. f \mathfrak{Zvi} .

While the author has for many years employed alkaline instillations and sprays in the after-treatment, he is somewhat doubtful as to the advisability of thus prolonging the operative manipulations. So soon as the trachea has been properly cleared, respiration freely established, and all hemorrhage arrested,—quite free oozing usually ceasing when the respiration has become free again,—the trachea-tube should be slipped into place between the blades of the dilator, and secured by tying the tapes at one side of the neck,—i.e., where they can be readily reached if the tube requires removal. The wound and the surrounding parts should be cleansed with a weak bichloride solution, and a small square piece of lint or muslin spread with iodoform cerate, cut down to its middle on one side, should be slipped beneath the collar to shield the wound. Unless the incision has been made unusually long, sutures had better be dispensed with. The patient must be carefully watched, especially if it has been anaesthetized, lest the tube be grasped and pulled out,—an accident which nearly proved fatal in the author's practice.

Laryngo-Tracheotomy, or division of the cricoid cartilage in addition to the first two or three rings of the trachea, is no doubt often unintentionally done during the high operation, and, in exceptional cases where the thyroid isthmus extends much higher than usual, may sometimes be done intentionally with advantage.

Low (Inferior) Tracheotomy.—For reasons already given, this operation

is more difficult and dangerous than tracheotomy above the isthmus of the thyroid, and, for croup, is in no way superior. Should the surgeon desire to operate thus, placing the patient in the same position as for the high operation, a free skin-incision should commence opposite the cricoid cartilage and end a short distance—say half an inch—above the sternum; divide upon a director the superficial fascia; carefully nicking the deep fascia, slit this up, being sure that the director does not slip between the leaflets of which it is here composed; this exposes some loose areolar tissue lying over the trachea between the sterno-hyoid muscles, which must be carefully torn through with the point of the director or the knife-handle, any veins that cannot be pushed aside being divided between two ligatures or two hemostatic forceps. When the trachea has been denuded of all fascial coverings at the point to be incised, the operation is to be completed as directed for high tracheotomy. In those cases where room enough cannot be secured by forcibly pulling up the isthmus of the thyroid with an aneurism needle, this structure should be secured and divided between a double ligature, or, if there is such urgent need of incising the trachea that there is not time for this procedure, the isthmus can be secured on each side by hemostatic forceps before dividing it, and ligatures be applied after respiration has been re-established.

The Complications and Dangers of any method of opening the trachea demand most careful study, although, if the directions already given have been followed, hemorrhage—the chief immediate risk—will have been avoided. Dry dissection with the director and knife-handle, reserving the cutting edge only for the skin and fascia and for the tracheal incision, with previous double ligation or temporary clamping with two pairs of hemostatic forceps before dividing any vein or artery,—applying ligatures, if requisite, after the trachea has been opened,—will usually prevent any serious trouble. The sudden arrest of respiration which sometimes occurs *before* the trachea has been opened can be met in but one way,—viz., instantly fixing the trachea with a tenaculum, lifting it slightly, rapid sponging away of blood, free incision of the trachea even through a pool of blood, the introduction of a dilator,—not a tube, although with no dilator at hand a canula must be employed,—throwing the patient forward, *for a moment*, while the trachea is cleared by a feather or forceps of blood and membrane, the introduction of a soft catheter well down into the trachea, and the prompt institution of artificial respiration. All these things can be done in less time than it takes to read about them, and usually these expedients suffice; indeed, they constitute all that can be done, unless a faradic battery be at hand, when an attempt to excite respiration should be made by passing a strong current, the positive pole applied over one pneumogastric in the neck, and the negative over the insertion of the diaphragm, varying this by stimulation of the intercostal muscles.

When blood has gotten into the trachea, owing to delay in introducing the dilator or tube or from excessive vascularity of the tracheal mucous

membrane, the trachea must be cleared by a feather, by the forceps, or by *blowing into* a catheter introduced well into the windpipe,—*not* by suction of the wound, which is most dangerous and usually of no avail.

Diphtheritic Infection of the Wound—not to be confounded with sloughing of the wound—is not very common, and is best met by the constant application of compresses wet with a one to two-thousand solution of mercuric bichloride.

Cellulitis.—This always follows tracheotomy to some extent, but it is only when excessive that trouble arises from the condition *per se*, this being that the ordinary tube will not be long enough to remain in the trachea, the swelling of the overlying soft parts actually lifting it out. The condition is a grave one, as indicative of a pronounced septic condition. All that can be done, beyond introducing a longer canula, is to give tonics and stimulants, using evaporating lotions externally; if pus forms, free incisions must be made, with full antiseptic precautions.

Secondary Hemorrhage.—This arises either from vessels wounded during the operation which do not remain permanently sealed, or from ulceration of the canula into the innominate artery, several such cases having been reported. If the innominate be opened, of course nothing can be done; but if the bleeding comes from the smaller vessels the ligature or cautery must be tried.

Emphysema.—This is said to be the result of too small an incision of the soft parts and of the tracheal opening not being in the median line, thus not coinciding with that through the superficial tissues; too short a canula; double incision by transfixion of the trachea; too long an incision, the canula escaping from the trachea; too short an incision, the air escaping into the tissues while the incision is being sought for and enlarged; tumefaction of the tissues displacing the canula; inflation practised through the wound.

When moderate and localized to the neighborhood of the wound, emphysema does no harm; but when generalized, involving the cellular tissue of the neck, face, arms, chest, and abdomen, the mediastinum also becoming infiltrated with air, dyspnoea recurs, and the prognosis is grave. The causation is clear: the violent inspiratory efforts producing a partial intrathoracic vacuum, the air gaining access by the wound readily infiltrates the intermuscular planes held tense, so as to enlarge the cellular spaces, by the spasmodic contraction of the muscles.

Treatment.—Removal of the cause, as the introduction of a longer canula, the treatment adapted to surgical emphysema however caused, with perhaps the application of collodion when the infiltration is localized, constitute all that it is possible to do.

Tracheotomy without a Tube.—From an exaggerated idea of the trouble in caring for, the risks of tracheal ulceration from, and the difficulties sometimes attending the final removal of, a tube, the attempt has been made by many surgeons to do away with canulæ. This has been done by carefully

exposing the trachea as before described, transfixing a portion in the median line with a tenaculum, and excising the ovoidal section included; by passing with a curved needle a stout ligature through each margin of a longitudinal tracheal wound, and either stitching each fast to the skin or merely securing the threads so as to keep the opening patent; by introducing a tracheal dilator, resembling a spring eye-speculum, or small wire retractors, —made, in an emergency, of hair-pins,—fastened together by an elastic band passing around the back of the neck, etc. While these measures may be useful when either no tubes are at hand or canulæ which do not fit, they are not to be recommended as a substitute for properly-constructed tracheal tubes when such are obtainable. The same remarks apply with even more force to the thermo- or galvano-cautery instead of the knife for incising the tissues, the security against hemorrhage in no way compensating for the disadvantages.

Rapid Tracheotomy.—In a few instances, when the surgeon first sees the case, respiration has just ceased, and death must result unless the trachea is immediately opened. Although often of no avail, a few patients will be thus saved. The author would distinctly discountenance any other plan but that of careful, deliberate exposure of the trachea when this is feasible, but there are exceptional cases where not a moment is to be lost. In such, rapid location of the cricoid cartilage, a bold incision strictly in the median line, prompt clamping with hemostatic forceps of anything that bleeds,—including the thyroid isthmus,—firm fixation of the trachea with a tenaculum, whereby it is lifted partly out of the blood-filled wound, a rapid pressure of the sponge, instant incision after this of the trachea, introduction of a dilator (a catheter or canula will do if no dilator is ready), combined with rolling the patient's face downward momentarily while the trachea is cleared of blood and membrane, and artificial respiration, have several times saved a patient in the author's experience. This plan is more generally applicable than Mr. Durham's, unless the surgeon has practised the latter.

After-Treatment.—That tracheotomy is a means to an end, not the end, must ever be borne in mind, for it only gives a respite from death by asphyxia, during which by constitutional and local measures the disease-processes may be subdued or spontaneously subside. Upon the proper after-treatment depends the ultimate fate of the case. As the natural provision for the filtration, moistening, and warming of the air—its passage through the naso-pharyngeal cavities—has been set aside by the operation, a substitute or substitutes must be provided, lest broncho-pneumonia result. The simplest and one of the most effective is to envelop loosely the neck and trachea-tube with a cravat formed of some loose-meshed fabric, as cheese-cloth, mosquito-netting, or veil material, moistened with a weak bichloride solution or with any other non-irritating antiseptic the surgeon may prefer; whenever soiled, the cravat must be renewed. The temperature of the room should be kept uniform, and at not less than 70° F. It is important that the inspired air should be saturated with moisture, because this favors sepa-

ration of the membrane, and also prevents inspissation of the mucus which produces clogging of the canula. As it is undesirable to subject the patient to the constant depressing effects of moist heat, unless absolutely necessary, in most cases allowing a spray of lime-water or of some alkaline solution from an ordinary steam atomizer to play across the orifice of the canula for about twenty minutes out of every hour will suffice, combined with the occasional instillation with an eye-pipette of a few drops of the alkaline solution mentioned. (See p. 403.) Where more continued moisture seems requisite, an improvised tent can be made by pinning blankets together around the bed, supported by a framework, into which the steam from a large tea-kettle can be conveyed by a piece of tubing, or a bucket of slaking lime can be kept at one side of the bed, the child being encouraged to inhale the vapor directly as it rises. The inner tube must be removed once or twice every hour for the first twenty-four hours, to clean it by removing, with a feather or a brush wet with the alkaline solution, all mucus, etc. Then dip it into a weak antiseptic solution and at once replace it. A good plan before replacing the inner tube is occasionally to gently pass the feather, wet with the alkaline solution, down the outer tube, and even a short distance into the trachea: this manœuvre will insure that the canula is perfectly free, and will also excite an attack of coughing, during which much mucus and even membrane is often expelled. Whenever the surrounding parts become soiled they should be cleansed with pledgets of absorbent cotton wet with bichloride solution, and a fresh piece of cerate-spread lint placed beneath the collar of the canula. When embarrassed breathing indicates a blockage of the canula which cannot be relieved by removal of the inner tube and the introduction of a feather, an attempt should be made to remove with the tracheal forceps the valvular piece of partially-detached membrane,—for it must under such circumstances be membrane, not merely mucus,—the rolled-up plug of membrane, or perhaps a complete tracheal cast, including portions of bronchial casts.

If these measures fail, and the difficulty of respiration increases, the surgeon should take out the canula, introduce a tracheal dilator, and endeavor to remove the obstruction with the forceps. It is often feasible to introduce the forceps into each bronchus in turn, and remove casts which extend into the tertiary ramifications of the bronchi. In case the tube suddenly becomes blocked with detached membrane when the surgeon is not present, the nurse—previously so instructed—must cut the tapes, remove the canula, and keep the wound dilated with a pair of hair-pin retractors until the tube can be cleared and replaced or the surgeon arrives. Some time during the third day the canula should be changed. By this time it is usually an easy task, the tissues having become glued together with lymph, forming a canal leading down to the tracheal opening, but, as it is not always so, the light should be good, the patient securely held, and, in addition to a clean canula, a catheter, tracheal forceps, and, above all, a tracheal dilator, must be within reach of the surgeon's hand. Wharton's suggestion that the nurse or

attendant be now allowed to replace the canula, so as to gain confidence if, in an emergency, she is compelled to remove it, is worth trying. Any decidedly blackened spot on the silver canula probably indicates some point of sloughing, which, if accessible, should be touched with mercuric bichloride solution or with iodoform. In from forty-eight to seventy-two hours the tube should again be removed, and left out for a short time before reintroduction, possibly also loosely applying a gauze compress over the wound to test whether the normal air route is being restored. For the same purpose the finger should be momentarily placed over the orifice of the tube from time to time, or it may be lightly corked.

Removal of the Canula.—As soon as the child can allow the canula to remain corked for some length of time without experiencing distress,—and this is from about the eighth to the fifteenth day,—an attempt to dispense with the tube should be cautiously made. Usually the wound promptly contracts, and should be covered only with a few layers of gauze, through which some air can enter, for the next four or five days, by which time the granulating process will have so far closed the wound that air no longer escapes; then any appropriate dressing can be kept firmly strapped over the parts.

Difficulties in Removing the Canula.—Spasm of the glottis, paralysis of the abductors, inflammatory thickening of the vocal cords, adhesions between the vocal cords, granulations around the wound, cicatricial stenosis of the trachea, and partial absorption from pressure of the tracheal rings allowing of collapse from atmospheric pressure, are the usual causes of difficulty in removing the canula. The treatment of granulations will be presently described; time, with proper local applications, will relieve the inflammatory thickening of the cords; diphtheritic paralysis of the abductors must be treated as elsewhere indicated; adhesions between the cords must be separated, either from above or from below, while both this condition and cicatricial stenosis can be best combated by the introduction of an O'Dwyer's intubation-tube, aided by appropriate incisions and mechanical dilatation of the strictured portion of trachea, the tracheotomy-wound being kept open by some such device as Parker's (Fig. 9) until it is evident that the canula will not have to be reintroduced. Spasm of the glottis, probably due, as Cohen

long ago pointed out, to the laryngeal muscles having lost the habit of contracting in harmony with the respiratory movements, must be met by careful removal of the tube for gradually-increasing intervals. Great tact and caution must be exercised lest the element of fright or of anger be imported, which seem to induce spasm by

FIG. 9.



Plug with shield to keep tracheotomy-wound from healing. (After Parker.)

interfering with the normal sequence of the complicated series of respiratory acts which we include under one general term. A condition is mentioned by Wharton where, in young children, the wound in the soft parts,

having united with that of the trachea, had assumed a valvular form, permitting but little air to enter the tracheal opening when the canula was out, while at the same time partial stenosis of the larynx persisted or spasm occurred. In such cases removal of the canula for gradually-increasing intervals, or the wearing of an intubation-tube while the tracheal opening is prevented from healing, is very properly suggested. The writer has seen a somewhat similar condition result, after long wearing of a canula, from absorption of the tracheal rings allowing a uvula-like valve of the soft walls of the trachea to be drawn inwards during inspiration.

COMPLICATIONS AFFECTING THE TRACHEAL WOUND AND THE RESULTING CICATRIX.

Exuberant Granulations.—These rarely occur except when the canula is retained for long periods; and this condition may be suspected when, after the gentlest reintroduction of the inner tube, blood-stained mucus is promptly coughed up. Corroborative evidence of the presence of exuberant granulations is afforded if, while the tube is out, more or less dyspnoea is complained of. Inspection when the tube is out will reveal the condition. The best treatment is the application of nitrate of silver fused on a properly-bent probe.

Ulceration of the Trachea which demands or admits of treatment occurs but rarely with the modern tubes, but if detected by the blackening of one spot on the silver canula it should be treated by the local application of the mercuric bichloride solution or nitrate of silver ten grains to the ounce, and the substitution of a longer or shorter canula, so as to remove pressure.

Vegetations.—A rare complication seen after healing of the wound is the development of tumors of granulation tissue, usually attacking male children from two weeks to a month after cicatrization has been effected. The symptom is progressively increasing dyspnoea. The treatment consists in a new tracheotomy, removal of the growths and cauterization of their bases, the temporary employment of a canula, and its removal if after a short time the growths show no disposition to recur.

Feeding Patients.—There is usually no difficulty experienced in swallowing liquid foods, such as milk, egg-nog, and broths; but should there be much of this regurgitated through the nose, from paralysis of the palatal muscles, semi-solid or solid foods may be tried. If all these expedients fail, recourse should be had to rectal feeding, or to the introduction of a soft catheter into the stomach with attached tubing and funnel by which the patient can be fed three or four times daily with liquid food: indeed, rectal feeding or this method of forced stomach-feeding should be unhesitatingly resorted to if sufficient food be not taken by the mouth, even though there is little or no regurgitation of food, because abundance of nourishment is imperative in diphtheritic affections. Alcoholic stimulants are valuable, and such drugs as quinine and digitalis, the latter serving the

double purpose of sustaining the heart and eliminating noxious materials from the kidneys.

CAUSES OF DEATH AFTER TRACHEOTOMY.

The prevalent idea that septicæmia resulting from the operation frequently produces death is an error, the septic trouble originating in most instances *before*, not after, tracheotomy.

Diphtheritic Poisoning is a far commoner cause of the fatal result, commencing before and being in no way influenced by the operation.

Broncho-Pneumonia, commonly initiated before operation, or at least strongly predisposed to by the intense pulmonary congestion and secondary changes resulting from the prolonged interference with the ingress of air, is a not uncommon lethal cause.

Pseudo-Membranous Bronchitis, producing symptoms of recurrent dyspnoea, may be said to complete the list of the usual causes of death after tracheotomy, for those perishing with heart-clot probably do so from the combined effect of pneumonia and the gradual heart-failure induced by the diphtheritic poison, the clot being favored by the weak heart-action, not primarily causing the arrest of this organ.

Treatment.—This varies in no wise from that indicated for septicæmia, diphtheritic poisoning, broncho-pneumonia, or pseudo-membranous bronchitis where tracheotomy has not been performed: indeed, the treatment already pointed out as requisite during the progress of a case after tracheotomy in reality comprises those measures best adapted to hinder the development and diminish the risk of those various conditions which tend to produce a fatal issue.

ESTIMATION OF VALUE AND MORTALITY; AFTER-CONDITION.

Without giving in detail the results of the statistical investigations of the many different observers who have studied the results of tracheotomy, in a general way the proportion of recoveries may be stated to be a little more than one out of every four operated on. Lovett and Monroe give as the result of nearly twenty-nine thousand operations about twenty-eight per cent. of recoveries. Recent improvements in the after-treatment certainly encourage the hope that in the future still better results will be obtained.

Age exerts a most marked influence on the results, for although recoveries from six weeks of age upwards exist in sufficient numbers to warrant a repetition of such attempts, yet the traumatic fever is usually so severe in the very young that death often results from this added to the effects of the original disease; consequently intubation is a safer procedure. The student is referred to the section on intubation, where the indications for the employment of tracheotomy or intubation are fully set forth.

The latest statistics available dealing with the subject of age as it affects mortality are those of Archambault, as follows :

Of 976 cases in children from 1 to 3 years of age, 104 recovered.

" 822	"	"	"	"	3 to 4	"	"	"	175	"
" 736	"	"	"	"	4 to 5	"	"	"	174	"
" 497	"	"	"	"	5 to 6	"	"	"	148	"
" 547	"	"	"	"	over 6	"	"	"	198	"

So far as permanent affections of phonation go, tracheotomy does not often seem to exercise much influence ; occasionally some hoarseness persists, but whether as the result of the tracheotomy-wound or of the original disease and its sequelæ, seems doubtful : moreover, there does not seem to be any special tendency to second attacks of croup or other laryngeal affections.

LUPOUS AND LEPROUS LARYNGITIS.

BY RAMON DE LA SOTA Y LASTRA, M.D., PH.D., LL.D.,

Professor of Surgical Pathology in the Medical School of Seville; Laryngologist and Dermatologist in the Polyclinic of the same; Knight of the Royal Order of Carlos Tercero; Corresponding Member of the American Laryngological Association, etc.; Seville, Spain.

TRANSLATED BY DAVID CERNA, M.D., PH.D.,

Late Assistant in Physiology, Demonstrator of, and Lecturer on, Experimental Therapeutics in the University of Pennsylvania; Corresponding Fellow of the Sociedad Española de Higiene of Madrid, etc.; Galveston, Texas.

PART I.

LUPOUS LARYNGITIS.

Definition.—Lupous laryngitis is a chronic inflammation of the mucous membrane of the larynx. It is characterized by a granular and tumefied condition of the membrane, due to the existence of a cellular neoplasm. The disease extends itself gradually, and on its disappearance leaves permanent cicatrices.

Lupous laryngitis may be primary or secondary in its nature, according as it appears first upon the mucous membrane of the larynx, or upon the skin, especially of the face, from which it may extend to both the larynx and the pharynx. Lennox Browne has insisted upon a distinctive diagnostic point between the malady in question and tertiary syphilis. According to this author, lupus always begins at the buccal membrane, while syphilis primarily involves the hard and the soft palate. I do not agree with this opinion, as I have often seen nasal lupus going as far down as the throat.

Primitive laryngeal lupus is rarely observed, but to-day it cannot be gainsaid that the disease may be developed originally in the organ of the voice. The cases reported by Ziemssen, Chiari, Riehl, Orwin, Garre, Baratoux, and those to which I myself shall refer, sustain this assertion. Though the affection may primarily arise in the larynx, it soon invades other neighboring parts. Therefore all that I shall say concerning the disease will have reference to lupus of the throat.

FREQUENCY.

The malady is not so rare as has been supposed by certain authors, although in some localities it is never seen. In Andalusia, Spain, for instance, it is quite frequent. Again, it is often difficult to distinguish this disease from tuberculosis, syphilis, cancer, and leprosy, as has been asserted by experienced dermatologists. I have myself been frequently unable to recognize the malady from the beginning, as happened in a case which I reported to the American Laryngological Association, and in which I did not become aware of the presence of lupus until after the cure was effected. The characteristic cicatrices left upon the soft palate enabled me to establish the correct diagnosis. Still a third cause for the alleged rarity of the affection lies in the fact that a thorough examination is not made at first.

I have made these remarks based on my own personal experience. In Seville, for example, where I have held the chair of laryngology and dermatology in connection with the Provincial School of Medicine, I have had occasion to examine a large number of patients suffering from throat-diseases. Unfortunately, I cannot refer to more or less exact statistics, but I may state, in general, that my lupous (of the throat) patients have not gone below one-fourth per cent., whereas those suffering from the cutaneous character of the disorder never went beyond six per cent. A similar statement is made by other laryngologists and dermatologists, though Max Bender did not find a single case of lupus of the throat in the three hundred and seventy-four patients examined by him. Both Ziemssen and Mackenzie consider it a rare disease. The latter author recorded personally two cases only, and was acquainted with others through the writings of Türk, Tobold, Ziemssen, Grossmann, and Lefferts. The rarity of the affection is similarly sustained by Gottstein, who has seen a single case of laryngeal lupus. Lefferts has reported four. On the other hand, Arning has affirmed that lupus of the throat is not rare in the clinic of Neisser of Breslau. It is worthy of note that patients suffering from laryngeal lupus seek treatment only at an advanced period of the disease, when this is accompanied with cutaneous manifestations, and hence dermatologists, as a rule, have superior advantages to see and study the malady. Nevertheless, Lennox Browne, who has had, among laryngologists, the best opportunities to observe the disorder, considers this of very rare occurrence. Out of twenty-five patients, two had the disease located in the larynx and three in the soft palate,—that is, the number gave an average of twenty per cent. Schrötter gives three per cent., and although Massei looks upon the affection as rare, the latter writer affirms that more cases of laryngeal lupus would be recognized and reported if a more thorough laryngoscopic examination were made. Middlemas Hunt believes that lupus of the larynx is not so infrequent as is generally supposed, and brings forth the statistics offered by Holm, Chiari, Riehl, Lennox Browne, Haslund, Marty, and his own, having collected in all four hundred and eleven cases. Of the three

hundred and eighty-one belonging to the last authors mentioned, eight and nine-tenths per cent. suffered from the disorder under consideration, while the other thirty of the first writer gave an average of twenty per cent. Out of three hundred and eighty patients examined in the clinic of Doutrelepont, one hundred and seventy-three exhibited the disease in the mucous membrane; of these, one hundred and sixty-seven were suffering at the same time from cutaneous manifestations and six from the malady located in the mucous membrane alone. Again, of the one hundred and seventy-three cases in which the mucous membrane was the chief seat of the lesion, seventy-five were affected in the nose, six in the lachrymal canal, twenty-five on the lips, thirty-one on the palate, one on the tongue, thirteen in the larynx, and one in the rectum and external genitals. Rice affirms that lupus of the mucous membranes occurs in twelve per cent. of all cases of ordinary lupus, but that the disease is rarely of a primary nature.

From the foregoing facts it will be seen that, although not so infrequent as has been generally supposed, lupous laryngitis is not a common disease.

ETIOLOGY.

According to Mackenzie, the causes of lupous laryngitis are not better known than those which produce ordinary lupus. Alibert, Rayer, Devergie, Hardy, and Bazin believe that lupus is a true manifestation of scrofula, and that the existence of the lupous tubercle, without any other symptoms whatever, is sufficient *per se* to diagnose a scrofulous diathesis.

The German school, represented by Hebra, Kaposi, and Auspitz, denies that scrofula is the cause of lupus, considering the disease as the result of a local irritation. Hutchinson believes it to be a special type of a chronic inflammatory process.

Friedländer asserts that lupus is nothing but a tuberculosis of the skin, based on the identical pathological anatomy of both affections. This, however, has been disproved histologically by other investigators.

Koch, who discovered the bacillus that bears his name, has pronounced tubercular all those pathological processes in which the micro-organism referred to is found. Pfeiffer has observed the bacillus of Koch in lupus of the conjunctiva. The same result has been obtained in all the cases studied by Doutrelepont. Similarly, Cornil and Leloir, in recent investigations, have found the bacillus of Koch, and have confirmed the result by inoculations. Leloir affirms that the tubercle of lupus is produced by the bacillus, and that therefore the disease in question is nothing but a local tuberculosis, which gives rise, in the course of time, to infection of certain organs or of the whole system.

The experiments of Koch are the most valuable of all, and they show that tuberculosis exists wherever the bacillus is met with.

Hunt believes that the tubercular origin of lupus is perfectly established, a general infection taking place through the lymphatics. A similar

opinion is held by Havenith, based upon the fact that the bacillus is found in the lupous nodule. The latter author likewise insists upon the fact that pulmonary tuberculosis is a frequent cause of death in lupous patients. Rice, who believes in the same theory, adds that persons suffering from lupus are peculiarly predisposed to pulmonary phthisis, this being also confirmed by the observations of George H. Fox, Demme, Raudnitz, and other writers. One-third of the two hundred and nine cases of lupus reported by Raudnitz gave evidences of tuberculosis. Of thirty-eight cases published by Besnier, eight had pulmonary phthisis; and Block, out of one hundred and forty-four patients, observed in one hundred and fourteen some tubercular manifestation before or after the attack of lupus.

All these facts, however, have been insufficient to induce Hardy, Kaposi, and Hutchinson to regard lupus and tuberculosis as identical disorders.

Hardy, putting aside the presence of the giant cells surrounded by the epithelioid cells, which should not be considered characteristic of the tubercle, since they are found in other affections, and may even be produced at will, according to the researches of Haidenhain, Ziegler, and Weiss, and, further, holding that the presence of the bacillus in scrofulous lesions is absolutely valueless, concludes that lupus and tuberculosis are two distinct disorders, since scrofula results especially from an individual diathesis, while tuberculosis alone gives rise to its characteristic tubercle.

Kaposi denies that lupus is a tubercular disease, and bases his assertion chiefly upon the fact that it has never been successfully reproduced by inoculation. I have already referred to the opinion of Hutchinson; but I will call attention to another statement made by this observer, according to whom patients suffering from erythematous lupus, in which bacilli have never been found, often exhibit a tubercular family history.

Riehl and Poltauf have found the bacillus more easily in necrotic lupus than in the ordinary form, and this sustains the probability of the contagiousness of the first form of the disease.

MacIntyre and Campbell likewise consider lupus and tuberculosis as two distinct maladies. The latter author affirms that, while lupus has a slow course, tuberculosis has a comparatively rapid march, and that, unlike tuberculosis, lupus attacks the buccal and nasal cavities, and does not invade the lungs nor produce dysphagia. The same writer does not give much credit to the results obtained from experimental researches on guinea-pigs, since many of these animals die from general tuberculosis without being inoculated with the bacilli.

Cohnheim and Perls and many other authors take the same ground in denying the identity of the two diseases; but, as a whole, it cannot be gainsaid that the majority of observers have come to the conclusion that lupus is nothing more nor less than a tuberculosis of the skin, notwithstanding its local manifestation and attenuated form. This belief has been strengthened by the recent discovery of Koch, tuberculine, by means of which the

tubercular nature of the disease under consideration is established beyond any possibility of doubt. In the clinics of Fränkel, Rosenthal, Hahn, Frael, Bergmann, and Krause, I have had occasion to observe the marvellous results obtained from the inoculations of Koch's tuberculine. I myself, in the polyclinic of the Medical School of Seville, have practised the injections on six lupous patients, and have been able to confirm the general and local reaction pointed out by Koch. Of this I will speak later. Koch, Bergmann, Schede, and Michael hold that this reaction is constant, and therefore characteristic of lupus. This, however, is denied by Hutchinson, König, Ehrlich, Kuster, and other investigators, since the virus, in some cases, has failed to act in lupous patients, and has, on the other hand, produced the peculiar reaction in entirely non-tubercular affections. Apparently the question remains *sub judice*; and while it is true that many facts point to the identity of lupus and tuberculosis, yet the same observers who hold this view admit, with Morrison, that the two diseases are different from a clinical stand-point.

Nevertheless, the theory of the tubercular nature, strengthened by experimental research, is the one that more satisfactorily explains the pathogenesis and development of the malady in question. Again, the apparent clinical dissimilarity between tuberculosis and lupus may be explained by the small number of bacilli found in the latter. Does not experience teach us that certain measures or drugs, for instance, such as alcohol, digitalis, caffeine, or the application of cold, produce different effects in the economy, according to the dosage employed or the manner in which they are used? The same holds good in regard to the action of morbid agents, the effects produced by these being in relation to the strength of the vital power. The disregard of this important factor has originated many an unnecessary question, such, for example, as the one under consideration, the one relative to the dissimilarity of croup and diphtheria, and many others. Does not the same poison produce a simple varioloid on the one hand and the most virulent attack of small-pox on the other? Is not the agent that produces a benign case of climacteric fever the same as that which causes the most fatal typhus? The quantity and the power of the same poison, whether vegetable or animal, determine, undoubtedly, the diverse phenomena, the dissimilar march, and the difference in the issue of pathological processes; and it is on this that the doctrine of attenuation of a virus and that of prophylactic inoculations are founded.

Admitting, then, that the tubercle-bacillus is the true cause of laryngeal as of any other kind of lupus, we must next study the most common conditions necessary to the development of the disease, especially with reference to heredity, and to the age, sex, constitution, and peculiar mode of life of the individuals attacked.

No one appears to have observed the malady in persons below three years of age. Kaposi affirms that lupus occurs at first during infancy, and later at the period of puberty. Hutchinson holds that it is not a dis-

ease of early life, but that it generally appears after puberty. According to Chiari and Riehl, in nineteen out of thirty-three cases of this affection the age ranged below twenty-two years. Rice believes that it occurs most frequently at the age of twenty-one. I myself have observed the disease more commonly in adult life. As to sex, of the thirty-three cases recorded by Chiari, twenty-five were women; of the two hundred and twenty-three reported by Kaposi, one hundred and nineteen belonged to the female sex. The same observation has been made by both Lennox Browne and Marty. It may be concluded, therefore, that lupus is of more frequent occurrence in women than in men.

Weak, debilitated persons, of lymphatic temperament, especially those suffering from a scrofulous diathesis, are the most prone to be attacked by lupus. Lupous patients, being generally weak, are predisposed to throat and skin affections. They exhibit mental torpor, indifference, general apathy and depression, sluggish movements, a feeble circulation, slow respiration, sleepy look, pallid cheeks, and, in fact, all the manifestations of a system run down by a constitutional disorder. Not all lupous patients, however, are necessarily of a scrofulous or lymphatic temperament. The disease often attacks the strongest and most robust constitutions.

Notwithstanding the existence of many points that would indicate an hereditary tendency, lupus is not an hereditary disease. The malady has never been observed in children under three years of age. The offspring of lupous patients sometimes inherit a scrofulous diathesis, and when, in the course of their development, they are subject to improper alimentation and other poor hygienic conditions, they become more prone to contract the malady in question; but the disease *per se* is not transmitted from father to son.

I have never seen a case of laryngeal lupus whose cause could be traced to the employment of alcohol or tobacco, to dust, cauterization, changes of temperature, or excessive use of the voice; but I believe that lesions of the mucous membrane enhance the activity of the tubercle-bacillus.

In a word, the true cause of lupus is the presence of the tubercle-bacillus, the disease being favored by certain predisposing conditions of the organism.

SYMPTOMATOLOGY.

Lupus of the throat is developed in a slow, insidious manner. It is often disregarded or not thought of, unless a local lesion of the skin or the presence of dysphonia leads us to make a close examination of the throat. The vocal cords are not affected until late in the course of the disease, sometimes not at all, and hence one of the difficulties of early diagnosis. I believe that the first manifestation of the malady is a more or less intense congestion of the mucous membrane, including the sub-mucous tissue, giving to this membrane a red or violet-red, dry, and shiny appearance. The peculiar hue disappears on pressure, which, however,

gives no pain. Patients complain only of a dry, tickling sensation in the throat. The congestion may deepen into an acute inflammation, and then the symptoms, generally of a catarrhal nature, are aggravated. The sensibility of the part is not, however, altered to any marked extent.

The congested and inflamed membrane becomes gradually tumefied and hard; its color passes from a more or less persistent brown to a pale rose, or may remain normal. I have often seen the tumefaction in a marked anæmic condition. Over the membrane there appear, in the course of time, several elevations of the size of a pin's head, looking like hypertrophied papillæ, involving even the subcutaneous tissue. At this time, no matter what the seat of the disease, the lupous nodules are hard and difficult to remove by means of the curette. This has been observed also by Luc and by my colleagues at the polyclinic. The tubercle has a round form, a smooth surface, and a contour so marked that it can be recognized with ease.

The *epiglottis*, which is the chief seat of lupus, is swollen, so much so sometimes as to depress the base of the tongue, assuming, according to Lef-ferts, the shape of a pig's snout, though hard, rigid, and immovable. Breda believes that the epiglottis is constantly affected, but this is denied by other authors. I myself have seen a case in which the only alteration of the part was a deviation towards the right, dependent on a total luxation of the larynx. The ary-epiglottic folds are shortened and pale, forming an indistinct mass with the enlarged arytenoid cartilages and tumefied surrounding parts. All these alterations about the superior opening of the larynx change the normal fan-shaped aperture into a narrow and more or less round hole. This deformity is in my opinion even more characteristic than the one pointed out by Ziemssen and Rice.

The *vocal cords*, remaining unaffected for a long time, are finally infiltrated by the disease, and appear then as two round bands, granular, reddish, with slow movements, and insufficient to close the glottis completely; hence the hoarseness of the voice and the labored respiration exhibited by many lupous patients. Some authors, notably Massei, assert that even the trachea may be involved. This I have never observed.

Nodules appear also upon the pyriform and glosso-epiglottic fossæ and upon the posterior wall of the pharynx, which presents a swollen, reddened, and thick granular condition, with dilatation of the blood-vessels.

The *soft palate*, covered with numerous granulations, is sometimes of a reddish color, but often retains the normal hue of the mucous membrane. The nodules on the palate, according to Köbner, are among the earlier manifestations of lupus of the throat. The pillars, especially the posterior ones, become so tumefied that they may attain the size of a man's thumb, as in the case reported by Mackenzie, in which the posterior wall of the pharynx was almost hidden from view.

The *uvula* also undergoes marked changes. It is often so hypertrophied as not only to reach the base of the tongue, but even to extend as far down as the epiglottis and give rise to disagreeable tickling sensations. This en-



LUPUS VULGARIS OF THE PALATE AND FAUCES.—Cicatrices, disseminated lupus nodules, and large and small tubercled ridges, upon the fauces, the velum, and the hard palate (Chiari and Riehl).



LUPUS VULGARIS OF THE LARYNX.—Tubercles and ulcerations at the base of the tongue, and upon the swollen, crumpled epiglottis; the left ventricular band thickened and tubercled (Chiari and Riehl).

largement of the uvula may cause a dry, troublesome cough, and even nausea and repeated vomiting. Sometimes this appendix increases in size in an uneven manner; thus, it may be pushed to one side or the other, or may take a downward or a forward direction; these alterations depending upon the amount of infiltration of the submucous tissue.

The *tongue* is often enormously swollen, especially at the base, the papillæ being markedly increased in size. In the majority of instances the organ loses its natural color and becomes, besides, hard and rigid to the touch, and thus mastication and phonation are made difficult.

Many lupous patients exhibit various disorders of *dentition*. In such cases the gums acquire a pale color, are swollen, granular, hard at first, but afterwards become soft. Often the mucous membrane of the cheeks presents a nodular appearance, especially over the space lying between the superior and inferior molars.

The *upper lip* is a frequent seat of lupus, and when affected is of a reddish or pale livid color, becoming deformed and everted. On both the cutaneous and mucous surfaces tubercles are found, varying in size and form, invading the superficial and deeper tissues. Sensibility is but little or not at all affected. The disease is less frequently observed on the lower lip.

Pari passu with the invasion of the upper lip lupus appears on the nose, and here the destructive action of the malady is quite marked. The organ is swollen, red, and covered with tubercles, these being soon followed by the appearance of vesicles and even pustules. The tumefied condition of the membrane is so marked as to obstruct the fossæ, and often to render impossible a thorough examination of the cavities.

No matter what their situation, the tubercles develop with extraordinary slowness, and their size varies from that of a millet-seed to that of a hazelnut. When they coalesce they form large masses. These masses are especially noticeable over the inter-arytenoid region, and growing towards the glottis they prevent the proper juxtaposition of the vocal cords; but the narrowing of the aperture, in my experience, has never been so pronounced generally as to interfere with respiration and to call for the performance of tracheotomy. Cases, however, have been reported of this nature, as for example my case No. I. The nodosities on the vocal cords impede free vibrations of the voice, and thus such lesions are a frequent cause of aphonia.

In the large majority of cases the lupous patches are seen to occupy portions of apparently healthy tissue; but often they are surrounded by congested or inflamed mucous membrane in a state of tumefaction with detachment of the epithelium. This loss of epithelium, produced by a sero-mucous exudation, gives rise to the formation of vesicles, and later of true pustules. Sometimes the affected part exhibits a psoriatic or ichthyotic appearance. It is in such cases that patients complain of pain on mastication and deglutition; but this hyperæsthesia bears no relation to the lupous disease itself.

After a certain period of time the lupous tubercle softens and breaks into an ulcer; sometimes it is gradually reduced in size, and finally completely disappears. In either case a characteristic cicatrix is left behind, which is still more marked in the dermal form of the disease. *Lupus non-exedens* of the throat is of rare occurrence, but it sometimes happens that a lupous patch disappears without having ulcerated, the change being brought about by atrophy and exfoliation. The non-ulcerative is one of the most characteristic forms of lupus; in the throat, however, it generally terminates in ulceration. Whether or not there is destruction of the epithelium, the tumor or nodule, round in form, becomes gelatinous at first, and soon thereafter of the consistency of barley sugar, according to French authorities, or of that of apple-jelly, according to Hutchinson. Ulcers appear then, more or less extensive and profound or as simple excoriations, all over the laryngeal or pharyngeal mucous membrane; even the whole of the palatine membrane may be involved. In the same way the epiglottis and uvula are often affected. An extensive ulceration may give rise to the production over the membrane of large fissures with prominent borders, and then even the cartilages and bones may become diseased. I do not agree with the distinguished dermatologist Hutchinson in his opinion that lupus does not attack the bones, and that this, therefore, constitutes a diagnostic point between the malady under consideration and syphilis. I have seen cases of pure osseous lupus, and Santwood has reported a most remarkable one of the same nature. Similar cases have been referred to by other authors. Lupus does certainly attack the bone tissue in the same manner as it does the skin, cellular tissue, muscle, and cartilage.

The borders of lupous ulcers are soft or hard, granular, and prominent. The centre of the lesions is red or of a violet color, though sometimes it is grayish or yellowish gray, of an amylaceous aspect, and there may be seen over it a diphtheritic film. These smooth, irregular ulcers may, in the course of development, give rise to the formation of highly vascular vegetations which bleed at the slightest touch. These vegetations can be easily removed by the curette. Lupous ulcers are comparatively of a dry nature, and they secrete only a small amount of sanious pus. No fœtor is exhaled by them. I have never been able to notice any disagreeable odor emanating from the palate or the nose, in even the worst cases of lupus.

The ulcers grow either slowly or with an extraordinary rapidity. In the first instance they grow and then cease to do so for a certain time; in the second, they grow rapidly day by day and nothing will stop their development. Sometimes, after they have acquired a certain size (usually a small one), no further change is observed for months or even years; and then, suddenly, without any apparent cause, they become exceedingly active and soon produce an extensive destruction of tissue. The epiglottis, the arytenoid cartilages, the ary-glosso and glosso-epiglottic ligaments, the uvula, the hard and the soft palate, and other surrounding parts may become partially or totally destroyed; then follow similar lesions of the antrum of

Highmore, the gums, the nose, the lips, and, on the whole, patients become most horribly disfigured.

Such changes produce disorders of function. Patients lose all sense of smell; articles of food find their way into the nose and larynx; the voice is hoarse and of a nasal character; articulation becomes difficult; pronunciation of words imperfect; speech unintelligible. Expectoration is scanty, although, according to Marty, abundant salivation is a constant symptom; but this I have never noticed. Pain, as a rule, is absent. Hutchinson considers the serpiginous ulceration characteristic of lupus. A complete cure is seldom obtained, but it does occur sometimes, either spontaneously or by therapeutic means. In these cases an irregular red or white cicatrix is left behind, together with permanent adhesions on different portions of the throat. These adhesions, according to their situation, produce difficulty in the respiration, and more or less complete aphonia.

The cicatrices likewise produce deformity in different parts, as a consequence of which there may be a constant dribbling of saliva, slow movements of the tongue, imperfect mastication and deglutition, narrowing of the nasal and buccal openings and of the isthmus of the fauces, and shortening of the ary- and glosso-epiglottic ligaments.

Cicatrization takes place very slowly, and sometimes years may pass before a mucous patch is completely healed up. On the disappearance of the ulcer there remains a permanent cicatrix, from which a detachment of epithelial cells continues, without producing excoriations. Sometimes, however, when the ulceration has been unusually deep, pain is apt to be elicited by irritating substances.

The foregoing description belongs to *lupus vulgaris*, the form which, according to Hutchinson, attacks especially the mucous membranes. These membranes are rarely affected by the erythematous form of the malady; but cases of this nature have been reported by various writers, notably G. H. Fox, Vidal, Kaposi, Besnier, Baratoux, and others. The two last-named authors communicated to Marty a case of erythematous lupus occurring in a man forty-seven years of age, who gave the following history. Both parents and two sisters were still living and healthy; a brother had died from softening of the brain. Seven years after marriage the patient's wife died of pulmonary tuberculosis. Two children were left, who, at the ages of twenty-one and seventeen respectively, were still enjoying good health. About three years previous to his present condition he had two successive attacks of pulmonary catarrh, and afterwards he complained of some cough and expectoration. There had been, nevertheless, no hæmoptysis nor any loss of flesh. Three years before he entered the hospital he had an attack of erythematous lupus over the left cheek, which was treated by scarification. Some time afterwards Besnier employed the galvano-cautery for about four and a half months, the patient leaving the hospital before a complete cure was effected. Shortly after he returned to the hospital with a new attack of the disease over the same place, invading

now the eye of the corresponding side. Besides the cutaneous affection, he was now suffering from pulmonary tuberculosis, and the laryngoscopic examination made by Baratoux revealed the following: paleness and tumefaction of the posterior commissure; a rosy hue of the vocal cords, with absolute immobility of the left vocal cord; and anæmia of the palatine vault.

This case is interesting from the fact that there is a possibility of the husband's having contracted the tubercular disease from the wife. Be this as it may, the case, on the whole, seems to corroborate the opinion of Hutchinson, who believes that erythematous lupus is the form that is most related to tuberculosis. Most of these cases generally present a tubercular history. To me the most characteristic sign of this form of the disease is the cicatrix formed without previous ulceration; but, on the whole, and without denying the existence of erythematous laryngeal lupus, I agree with Hutchinson and Lefferts that it is exceedingly rare.

Returning to lupus vulgaris, some authors affirm that the disease produces anæsthesia in the affected parts, to the extent of patients being able to undergo operations without the manifestation of pain. Such has not been my experience; and although I have found that lupus of the throat is more or less indolent, as compared with lupus of the skin, yet it does not produce complete insensibility, as shown by the fact that I have always been obliged to resort to the use of cocaine in cases of operation.

As a rule, individuals suffering from lupus of the skin are not affected in their general health and spirits, and this may be observed for months and years. Not so with those attacked by lupus of the throat, mouth, and nose. The various symptoms already described produce a general depression of the system; thus, the loss of the voice, the difficulty of swallowing, of breathing, of proper alimentation, and so on, are all factors which contribute to the failing health, and, in the course of time, to the moral and physical wreck of these patients.

Fortunately, *visceral tuberculosis* is not a frequent complication of lupus. Hutchinson believes that a lupous patient rarely becomes tuberculous. On the other hand, the experiments of Koch, Cornil, Leloir, Max Schüller, and others show that inoculations of the lupus-bacillus cause general tuberculosis. According to the statistics of Baumgarten, of four hundred and eight lupous patients, 67.9 per cent. gave evidences of the tubercular affection. Besnier, out of thirty-eight cases, found that eight had phthisis pulmonalis, and Leloir discovered tubercular disease of the base of the lung in ten cases out of seventeen examined by him. Hunt says that such a frequent co-existence of the two disorders is not seen in England. I may say the same thing in regard to Spain; in fact, I have never observed a single case of lupus complicated with pulmonary phthisis. I have noticed infarction of the cervical glands which has terminated in resolution, induration, caseation, or suppuration. According to Hutchinson, some authors have found cancer a frequent complication of lupus. I have never observed this com-

plication in patients suffering from lupus of the throat or of the skin, notwithstanding that in Spain cancer is not a rare disease.

MARCH, DURATION, AND TERMINATION.

The march of lupus is essentially slow, with the exception, perhaps, of the phagedenic form, which soon produces terrible destruction of tissue. I have seen the epiglottis disappear in two weeks, and in a month the complete destruction of the uvula, the soft palate, the right tonsil, and a portion of the pharynx.

One of the most characteristic features of lupus is its *eccentric growth*. It is propagated through the borders of the ulcer, one portion of which may be wholly cicatrized, while the other continues on its march of infection and destruction. Thus, in the same patch may be noticed redness, œdematous infiltration, hard and soft nodules, ulcers on the edges around the circumference, cicatrices in the centre. The disease progresses until the mucous and submucous tissues are completely destroyed.

Generally lupus becomes circumscribed in one region, and ceases to grow when it reaches a superficial aponeurosis; after a certain time this barrier is removed and its further propagation is more or less rapid, involving in its dreadful march muscle, cartilage, and bone.

The *eruption* appears within no definite limit of time, and when it does come it may last for weeks, months, and even years. I have never observed a cure to take place in less than two months. Sometimes the disease remains stationary for a considerable period; in such cases the lupous infiltration may disappear completely, leaving behind a cicatrized condition of the parts, which, although somewhat tumefied and deformed, are apparently healthy. Nevertheless, this is not a complete cure, for in the course of time a new lupous eruption makes its appearance over the region of the old one, and the malady continues its work of annihilation of tissue. This sudden and often repeated breaking out of the eruption is a feature peculiar to lupus, and hence the error frequently committed in regard to the discharge of patients as having been perfectly cured when such is not the case. Yet a cure may take place spontaneously, and this occurs oftener, perhaps, than is generally supposed. Again, many cases get well without any therapeutic treatment.

Lupus is not a *mortal disease*; but the laryngeal form of the malady may, according to the changes produced in the organ of the voice, cause asphyxia and inevitable death unless tracheotomy is resorted to. A notable case of this nature is reported by Schley, occurring in a woman forty-four years of age, who, refusing to have the operation performed, succumbed suddenly to an attack of suffocation. Apart from this cause, laryngeal lupus rarely produces death. I know of one case, however (lupus of the face), in which a fatal issue was attributed to the disease, but even in this instance the result was due to an infiltration into the brain through a necrosed sphenoid. The patient died with symptoms of tubercular meningitis.

PATHOLOGICAL ANATOMY.

I have already called attention to the general symptomatology of the disease, and have described the changes produced in the mucous membrane. In speaking, however, of the anatomico-pathological and macroscopical alterations proper of laryngeal lupus, I would say that those changes vary according to the part of the organ affected and the duration of the disease, or according to the period at which the examination is made. Regarding the microscopy of the malady, most authors agree with Virchow that the lupous nodules are made up of granular tissue, quite vascular, containing small round cells, due to a proliferation of the connective tissue and not of the epithelium. The epithelial layer remains unaffected at the beginning, but is afterwards infiltrated with embryonic cells which increase its thickness. It finally disappears, the papillary surface of the dermis becoming a mass of embryonic elements. These elements infiltrate the mucous membrane, and in them are embedded the lupous nodules. Raulin has described this morphological structure as follows. The principal mass is composed of cells richer in protoplasm than the embryonic elements, with a diameter two or three times as large, and having two or three nuclei. The protoplasm is opaque, granular, and of round form, being made up of epithelial cells. Near the centre of the mass are found the giant cells of Friedländer, of oval shape, with prolongations, their protoplasm being granular, and with large oval nuclei near the periphery of the cells. These giant cells are few in number, usually from one to five, and it is in them that the bacillus of Koch has been found. This microbe is exceedingly rare and difficult to find. Koch himself found the bacillus only in the twenty-seventh section of one of the specimens examined by him. Gottstein says that in one of the preparations of Ehrlich a bacillus of the size of a tubercle-bacillus could be seen in a giant cell.

DIAGNOSIS.

When laryngeal lupus coincides with, or is preceded by, lupus of the skin, it is not difficult to recognize, since the cutaneous manifestation of the disorder is exceedingly characteristic. Not so when the disease appears primarily upon the larynx: it then becomes quite difficult to make a correct diagnosis. Often the affection exists in the throat before it is even suspected by the keenest observer.

Nevertheless, when there appears an infiltrated condition of the tissues forming the superior orifice of the larynx, by which the normal fan-shaped form of this organ is changed, accompanied with a rosy or reddish hue of the mucous membrane, this becoming covered with tubercles and ulcerations as if worm-eaten; when there are shortening and thickening of the ligaments; and, above all, when there are established irregular cicatrices, with or without previous ulceration; all these symptoms indicate the unequivocal

existence of lupous laryngitis, even though there be no cutaneous manifestation.

This disorder may be confounded with simple chronic laryngitis, as also with the tubercular, pachydermal, syphilitic, cancerous, and leprous forms of the disease, all of which may exhibit similar lesions. Therefore it is only by exclusion that the true nature of lupous laryngitis can be definitely established. In simple chronic laryngitis the hue of the mucous membrane is more pronounced, but the surface of the latter is smooth, not granular as in lupus; besides, there is no alteration in the natural contour of the parts, and the epithelial detachments do not give rise to ulcerations, and consequently no cicatrices are left. There is also in simple chronic laryngitis a troublesome mucous secretion which may last for months and even years, but no destruction of tissue is effected; nor is there, as in the case of lupus, a continuous and eccentric growth of the disease.

The diagnosis between lupous and tubercular laryngitis is, undoubtedly, a great deal more difficult to establish, and this will be understood when it is known that the two forms of the disease belong to the same affection, each presenting a different degree of intensity. The differential diagnostic points between the two diseases are, on the whole, chiefly physical and clinical, and even here there is a diversity of opinion. Lupus is generally preceded by a period of congestion, and is, therefore, developed upon a reddish membrane. Tuberculosis is usually developed upon a pale membrane. In lupus, tumefaction affects all the parts concerned in the formation of the superior laryngeal opening. In tuberculosis the infiltration is limited to one or both arytenoid cartilages, the pyriform swelling of which is quite characteristic; sometimes the ary-epiglottic ligaments and the inter-arytenoid space are affected, but the tubercular disease rarely destroys the form of the parts involved. The lupous nodule is slow, that of tuberculosis rapid in its ulcerative changes. Lupus attacks the vocal cords at a late period; whereas in tuberculosis they are the first ones to be affected. The lupous ulcer is indolent and dry; the tubercular ulcer is painful and is covered with a sero-purulent discharge. Lupous ulceration tends to repair the tissues by granulation; tubercular deposits do not lead to the formation of new, permanent tissue. Lupous ulcers lose their vegetating aspect only when cicatrization has occurred; tubercular ulcers are always somewhat depressed, anfractuous, with a fundus that is quite granular. Lupous infiltration is deep; tubercular ulcers are superficial. Lupus cicatrizes; tuberculosis rarely does so. Lupus is developed slowly; tuberculosis in a comparatively rapid manner. Lupus usually attacks the mouth, nose, fauces, larynx, etc.; tuberculosis generally invades the pharynx, the vocal cords, the lungs, and other viscera. Lupous patients may live for a long time in a comparatively healthy condition; tuberculous patients are weakened, lose flesh, and the hectic fever consumes them gradually. Lupus is rarely fatal; tuberculosis usually terminates in the death of the patients.

Smooth or warty pachydermatous laryngitis can hardly be mistaken for lupous laryngitis, either from a laryngoscopical or an anatomico-pathological point of view. Aside from some distinguishing features, the hyperplasia and metaplasia of the epithelium and the changes occurring in the corium, which give to the mucous membrane the epidermic character, are alone sufficient to distinguish pachydermatous laryngitis from any other affection of the larynx.

The lesions presented by lupous laryngitis and those produced by syphilis of the organ of the voice are so similar that only the history of the patient and the results of the treatment will enable us to form a correct diagnosis. In both diseases the tubercles tend to suppuration, producing destruction of tissue and deformity of the parts affected. In syphilis the infiltration is more diffused and indurated, the tubercles are harder, broader, darker, more round, and more apt to ulcerate. Again, in tertiary syphilis the ulcers are deeper and do not present the worm-eaten appearance which characterizes the lupous lesions; the fundus of syphilitic ulcers is of an ashy, dirty color, covered with a yellowish creamy pus or with vegetations. Lupus, as a rule, is slow in its action; syphilis generally takes a rapid course when it has once invaded the throat. I have already referred to the distinction between the two diseases offered by Lennox Browne, which is not admissible. The absence of necrosis has likewise been considered a distinguishing feature; but, as Hunt has remarked, many cases of true lupus have given unmistakable evidences of necrosis. Syphilitic cicatrices are a great deal more extensive than those of lupus, but the former lack the fresh outbreaks of ulceration which Chiari considers as a pathognomonic sign of the lupous malady. Finally, upon the vegetating surface of syphilitic ulcers a kind of vital exaggeration, so to speak, is noticed, not seen in lupus, whose work is usually that of destruction.

The true diagnosis between syphilis and lupus remains *sub judice*, and often we have to resort to the anti-syphilitic treatment in order to arrive at a final conclusion regarding the nature of a case; and sometimes even then certain doubts cannot be dispelled. One of the most interesting cases of this kind is that published by Norris Wolfenden, which I believe to have been one of lupus and syphilis combined.

Laryngeal cancer occurs only after middle life or in old age, and at a time when the individual is apparently enjoying the best of health. In its development it is somewhat more rapid than lupus. It is accompanied with acute lancinating pains which radiate to the ear. This latter symptom is considered by Ziemssen peculiar to the disease. However, it is not so looked upon by other authors,—notably, by Fauvel and Mackenzie, who further believe that the pains of cancer are limited to the larynx when there is no ulceration, but that when this occurs, as happens in other affections, the pains are radiated to the ear. The cancer tubercles are of a rosy reddish or grayish color, smooth, granular or tabulated,

sessile or pedicellate, of variable form, of slow but continuous growth, and of a soft or hard consistency. They are attended with more or less difficulty in swallowing and breathing. The voice is hoarse. The ulcers are characterized by an irregular, excavated fundus which is almost always covered by a viscid, sanious discharge. Sometimes there is hypertrophy of the cartilages, and the thyroid assumes the shape of a tortoise-shell. The breath of cancerous patients is fetid, and salivation is abundant. Death takes place suddenly through an attack of suffocation, or slowly from exhaustion.

Leprous laryngitis exhibits such characteristic cutaneous lesions that it can hardly be confounded with the lupous form. The mucous membrane presents spots of a carmine color, while the surrounding parts assume a deep reddish tint. The tubercles vary in size from that of a pin's head to that of a pea, and are disseminated or form small groups; they are soft and somewhat painful at first, but afterwards they become painless. These tubercles appear on the pharynx and larynx, and give to the epiglottis a peculiar rigidity which characterizes the deformity. In leprous laryngitis there is also hoarseness of the voice; patients have a fetid breath, and often exhibit difficulty in swallowing and breathing. Leprous cicatrices are white, thin, stretched, deformed, and painless.

Psoriasis has been confounded with squamous lupus, but this latter can be distinguished by the presence of the tubercles and by the characteristic cicatrices.

Finally, we can resort to two diagnostic points of great value: the presence or absence of the bacillus of Koch in the lupous nodules, and the reaction of tuberculine upon the diseased part.

Unfortunately, it is difficult to find the tubercle-bacillus, even in cases of true lupus. The presence of the bacillus is sufficient to determine the correct diagnosis, but its absence in a suspected case does not prove the non-existence of the disease.

The other diagnostic means consists in the reaction of tuberculine, whose usefulness has been recognized by unbiassed observers. Breda believes that the lymph exercises a most remarkable revealing power in lupus vulgaris, even though some cases appear to be completely unaffected by it. I fully believe in the usefulness of tuberculine as a diagnostic agent, and that in almost every case it produces the local and general symptoms pointed out by Koch. I have had numerous opportunities of observing this in Berlin at the clinics of Fränkel, Rosenthal, Hahn, v. Bergmann, Krause, Leyden, and Israel. My personal experience in the matter has been limited, but sufficient to convince me of the value of the lymph from a diagnostic point of view. It has been said that tuberculine produces the same reaction in other non-tubercular diseases; but Ehrlich has affirmed that only two other affections respond like tuberculosis to the influence of the lymph, — *actinomycosis* and *leprosy*. This has been confirmed by the case of Ponfiek, reported by F. W. Hime.

I attribute no diagnostic value to the heart-shaped epiglottic ulcer which has been pointed out by Ziemssen as characteristic of lupus, because the same condition exists in some non-lupous diseases.

PROGNOSIS.

Although the disease may cause death suddenly by asphyxia, as has already been intimated, lupus is not acutely fatal. Nevertheless, the prognosis is always bad. According to Raulin, the epithelial changes which the lupous cicatrix undergoes increase the gravity of the disorder.

TREATMENT.

The treatment of lupus must be directed to destroy the germs, to sterilize the field upon which these micro-organisms grow, and to remedy as far as possible the terrible effects produced by the disease; it must, therefore, be both local and general. The local treatment *per se*, as believed by some practitioners, is not sufficient to combat the malady in question. The general treatment is just as important. To this, in fact, according to the American dermatologist Duhring, are due the recoveries that have been obtained in cases of lupus; but this cannot be said of the results of such treatment here in Europe. In many cases the affection attacks strong and robust persons enjoying, apparently, the best of health, which shows that the condition of the organism indispensable for the development of the characteristic germ remains as yet unknown.

The *local treatment* of laryngeal lupus must differ according to the period at which the disease is combated. In all the stages of the affection, however,—the eruptive, the ulcerative, and the cicatricial,—the most vigorous antiseptics should be practised. I believe that resorcin in the strength of one per cent., applied in the form of gargles, atomization, irrigation, etc., constitutes the best means of disinfecting the mouth, throat, and nose. Mackey has reported to the Sussex Medico-Chirurgical Society two cases of lupus cured in a few weeks by the local application of resorcin in the form of ointment of the strength of twenty per cent. The application of the medicament, which was made after scarification, was but slightly painful. Another case illustrative of the same successful treatment is reported by Black.

Antisepsis by means of carbolic acid solutions is disagreeable to many patients, and is not more efficacious than that produced by means of resorcin. The local application of bichloride of mercury in solutions of the strength of one to a thousand, as recommended by Massei, I consider dangerous. I believe boric acid to be the best substitute for resorcin.

If the swelling produced by the lupous infiltration is not great or hard, touching the parts with the iodated solution of Mandl may be practised with advantage. If the tumefaction is more or less large and hard, the best results are achieved by linear scarification, followed by the application of a mixture of dilute lactic acid and glycerin, equal parts, or two to one

respectively. Before resorting to scarification, local anaesthesia must be produced by means of a ten-per-cent. solution of cocaine, or by the hypodermic injection of three or four drops of a solution composed of one gramme of hydrochlorate of cocaine and ten grammes of a two-per-cent. solution of phenic acid.

If the epiglottis is to be *operated* upon, from three to five parallel incisions must be made with the Stoerk knife from the tubercle of Czermak to the insertion of the ary-epiglottic ligaments. The blood must be allowed to flow freely, and when a sufficiently large amount has escaped, the hemorrhage can be stopped by the application of absorbing cotton previously immersed in a solution of chloride of zinc of the strength of one to thirty. This solution is astringent, slightly caustic, and antiseptic. For operation upon the border of the epiglottis, the ary-epiglottic folds, the arytenoid eminences, or the border of the inter-arytenoid space, the laryngeal knives of Tobold or Heryng must be used. In scarifying the ary-epiglottic folds, care must be taken not to injure their external surface, as there is danger in so doing of wounding the superior laryngeal nerve. After the hemorrhage is stopped the parts must be touched with the solution of lactic acid.

Isolated lupous nodules are easily destroyed by the thermo-cautery. I am in the habit of employing the fine-pointed instrument, as with this I can penetrate as deeply as desired, repeating the operation as often as I judge necessary. Although little pain is produced by this means, previous local anaesthesia is desirable. For cutting or scraping I prefer the knife or the curette.

For the apple-jelly-like *vegetations* I believe the best treatment to be scraping, followed by cauterization. The diseased tissues cannot be completely removed by scraping, but the rest of the vegetations and the nodules can be completely destroyed by the galvano-cautery, or with a concentrated solution of chloride of zinc. I prefer the cautery, but the zinc and the lactic acid solutions may be employed with advantage.

Simple ulcers, free from vegetations, but in a state of inflammation and suppuration, may be washed first with a solution of resorcin and afterwards dusted over with iodoform. In these cases I believe with Leloir that an energetic treatment is contra-indicated. The simple treatment referred to suffices, and, in fact, enhances cicatrization.

Adhesions formed upon the vocal cords, as the result of cicatrization, are to be destroyed by the blunted and curved knife of Tobold, and, in order to prevent their being renewed, the intubation of O'Dwyer must be practised, which is more efficacious and less troublesome than the introduction of the dilators of Schrötter. If owing to the irregularity and the large number of the cicatrices intubation cannot be practised, tracheotomy must be resorted to. Adhesions formed upon other portions of the throat and mouth can be destroyed by the galvano-cautery. Perforations of the soft palate can be treated by means of obturators, in order that the patient may speak and swallow with greater facility.

The *general treatment* is similarly various, according to the state of the economy. If the patient is strong and of a robust constitution, no internal medication is necessary; the local treatment alone is sufficient. If, however, the patient is of a strumous or scrofulous diathesis, then the internal administration of tincture of iodine in increasing doses, iodide of iron, sulphur, cod-liver oil, and bitters must likewise be resorted to. Patients with symptoms of herpes, rheumatism, or syphilis must be placed under the arsenical, the alkaline, or the anti-syphilitic (mercury and iodide of potassium) treatment respectively. These cases may also derive much benefit from the use of mineral and thermal waters, and sea-bathing, combined with the most rigorous attention to hygiene.

The combination of the foregoing treatment, local and general, has been considered by practitioners as the most efficacious in the management of lupus. No *specific medication* had been proposed for this disease up to the time when Koch, first in the International Congress of Berlin, 1890, and afterwards in the columns of the *Deutsche Medicinische Wochenschrift*, announced the discovery of a remedy for tuberculosis. I will say nothing of the exaggerated enthusiasm created by this announcement, and of the great disappointment that followed. On the whole, after examining the subject from a philosophical point of view, it has seemed to me that the announcement was premature. Nevertheless, although the new agent is far from being able to wholly destroy tubercular disease, it does, I believe, exercise a marked influence; but exactly how it acts, how it does good in some cases, harm in others, we do not yet know. The failures attributed to tuberculine are not yet sufficient to condemn the remedy as useless and dangerous; future investigations may show that positive benefit is to be obtained from its employment, especially when the proper method of its administration and its properties are fully known.

I have said that I have never seen a case in which the lymph did not produce a more or less marked effect, through a local manifestation. I can speak of only one case of cure, and I am not sure of even this being a definite one. Since the disappearance of the lupous nodule, seven months ago, no return of the disease has been observed.

The use of *tuberculine* has been large, especially in Germany. For the literature of the subject I refer the reader to the Transactions of the Twentieth Congress of German Surgeons, held in Berlin, and especially to the opinions there expressed by Thiersch, von Bergmann, König, Kuster, Schimmelbusch, Levy, Lesser, Rotter, Urban, Hahn, and Esmarch. All these authors agree that tuberculine exercises a beneficial influence upon tuberculosis, particularly in lupus, but that it does not cure. This is, I believe, the opinion entertained to-day by all unbiassed practitioners. Similar conclusions have been arrived at by Michael and Mackenzie. The latter has said, "Koch has made a most important discovery, and when the details as regard dosage have been thoroughly worked out, and conclusions have been arrived at as to the best kind of remedies, constitutional

and local, to combine with it, tuberculine will prove a most valuable addition to the curative agencies in the hands of the physician." The same may be said, regarding the uses of the lymph, of the results obtained from the extensive trials of Lennox Browne, Moritz, Schmidt, Ehrlich, and others. Ehrlich says, "The healing properties of tuberculine are generally recognized as exclusively dependent on its local specific influence on the tuberculous tissues. Prolonged experience with the employment of tuberculine has shown that in order to secure the desired therapeutic effect it is neither necessary nor desirable to produce severe local reaction. To get the best results smaller and more frequent doses are preferable. The essential principle of the healing process is to effect the encapsulation of the tuberculous tissue after the manner of cicatrization. This can be best obtained by maintaining the specific irritability of the diseased tissues as long as possible, and not (as in the early method) by destroying by large and rapidly increased injections." The same author believes, besides, that large doses of tuberculine diminish the reacting power of the tissues, and that therefore the continuation of the remedy is useless. Koch himself recommends to-day the employment of doses not so large as to produce a general reaction; a temperature of 38° C. shows the efficiency of the quantity administered, and this can generally be produced by an initial dose of no less than 0.001 gramme. This amount may be repeated, according to the exigencies of the individual case, every two, three, or four days. The dose must not be increased until the reaction has entirely disappeared. If hectic fever is present, the bodily temperature cannot be taken as an index for the graduation of the dose, and it is then better to administer the remedy several times a day in very small doses, such, for example, as 0.0003 to 0.0005 gramme, increasing them with great precaution. This method gave the most satisfactory results at the Moabit Hospital of Berlin. It was found that during the first eight or fourteen days the hectic fever would disappear. Ehrlich calls attention to the fact that in the wards of Sonnenburg still better results were obtained by a combination of tuberculine injections and mercurial inunctions. Although this combination is inapplicable to throat affections, yet the results produced sustain the opinion of Urban that lupous patients, before operation, should be placed under treatment by Koch's method. Lupus of the throat may be treated locally as I have indicated, but at the same time patients should be given the benefit of tuberculine, through which, according to the extended experience of Hahn, a quicker, a surer, and a more radical cure may be expected.

In concluding this study of lupus of the throat I wish to give the history of the following three cases, which will serve as illustrations of what has been said throughout this article.

CASE I.—Esperanza Ramos was born at a double delivery, the fourth of the same nature accomplished by her mother. She was a healthy baby. The father never suffered from syphilis. The mother died suddenly about a year ago from heart-disease. The seven brothers of the girl died during

infancy, all with symptoms of tympanites and diarrhœa, and two or three of the children with convulsions. No relative on the parental side had died from phthisis. At eight years of age our patient had ophthalmia, from which she recovered, to be next attacked by suppuration of some of the cervical ganglia. Soon after, the disease of the throat appeared, with symptoms of dysphagia and dyspnœa, but no signs on the mouth or the fauces. A tumor was then noticed on the soft palate, which ended in suppuration, leaving behind a perforation through which articles of food would find their way to the nasal chambers. She was sent afterwards to an asylum, where she was cauterized and advised sea-bathing. No improvement followed. Shortly after, another cervical ganglion became inflamed, suppurated, and was several times cauterized, but no cicatrization took place. The patient had then a severe attack of stomatitis; the velum of the palate was destroyed rapidly, which contributed largely to the difficult respiration experienced by the girl. She became my patient under these circumstances. She was then eleven years of age and in an extremely anæmic condition. There was an ulcer situated back of the right angle of the inferior maxillary, on the right side; the lesion was excavated, with irregular fundus, thick, red, and loose borders. Another ulcer, deeper, but presenting similar characters, was found on the left submaxillary region; its borders had not yet become loose. From both ulcers exuded sero-pus. A white, depressed cicatrix two centimetres in diameter was found on the left side of the neck, between the sterno-cleido-mastoid and the anterior scalene muscles. The nose was deformed from complete loss of the cartilaginous portion of the septum. Lips, cheeks, and gums were apparently healthy. Several teeth had fallen out. A grooved ulcer running from the base to the tip of the tongue divided this organ into unequal parts; it was so deep as almost to perforate the tongue. The perpendicular borders of the ulcers were covered with soft granulations which bled and were painful to the touch. On the left side of the tongue were four tumors separated by transverse grooves. There was another ulcer, wider, but also grooved, on the base of the tongue; the borders of this ulcer were likewise covered with vegetations. The glosso-epiglottic fossæ were the seat of tumors, these reaching over the superior surface of the epiglottis and covering the pharynx even farther down than the finger could reach. The nodules forming these tumors varied in size; all were hard, bled, and gave pain on compression. The hard palate and the anterior two-thirds of the soft palate, though pale, were healthy; the posterior third of the right side had disappeared, its place being occupied by an excavated, fungoid, irregular ulcer which extended from the tonsil to the pharynx. The anterior left pillar was adherent to the back of the tongue; of the posterior, only the superior half was left, and that was covered with red and hard nodules. The right tonsil was reduced to a very small size; the uvula had disappeared, and in its place was a large granular ulcer. The posterior wall of the pharynx was reddened, and upon it were observed some granulations. The larynx

could not be seen, owing to the fact that the epiglottis completely overlapped the superior opening. Dyspnoea was so pronounced that I was obliged to perform tracheotomy.

The patient is to-day twenty-one years of age. She has carried her canula, without the least trouble, for the last ten years. I have not been able to effect a cure, although I have employed every means at my command. She has developed quite well; menstruated at fourteen, and her menses have ever since been regular. She is stout, of a cheerful disposition, swallows easily, and breathes without difficulty through the canula. Her voice is exceedingly hoarse. She has a slight cough, the mucous expectoration being quite abundant. She takes cold easily. Her breath is not offensive. Three years ago an adenomatous tumor appeared upon her right hand, but it has remained stationary, indolent. The ulcers of the neck, tongue, and soft palate have all cicatrized. The right side continues in the same condition. From the left side the anterior pillar and the tonsil have completely disappeared, while the posterior pillar has united cicatricially with the wall of the pharynx. The vegetating nodosities upon the glosso-epiglottic and pyriform fossæ continue in the same condition; perhaps somewhat diminished in size. I am now better able to see, although in a more or less confused manner, the vestibule of the larynx, which I find covered with vegetations. I have several times made attempts at intubation, with the object of freeing the girl from the use of the canula, but, unfortunately, without success. Everything in the way of medication has now been abandoned.

CASE II.—José Muñoz, fifteen years of age, applied for treatment at the Polyclinic of the Medical School of Seville on the 14th of January, 1890. The boy was from the country, of a robust, healthy constitution; had never suffered from anything until a year ago. His parents are both living and healthy. A brother-in-law of his grandmother and a cousin of his mother died of consumption. He has had seven brothers; two died from cerebral disease. There is no history of syphilis in the family. One afternoon, while running and playing with other boys, he went into the house and, heated and perspiring as he was, drank large quantities of cold water. He felt hoarse a few moments afterwards, and there soon followed a severe laryngitis, which lasted for two months, notwithstanding his having been treated with sudorifics, balsamic remedies, and chlorate of potassium. He continued hoarse, and a slight cough set in. These symptoms disappeared the following summer, but the hoarseness returned during the winter.

When I saw the patient for the first time, with the exception of aphonia, no bad symptoms were noticed; his general health was good. Examination of the throat revealed a pale condition of the mucous membrane of the palate, but a reddened appearance of all the surrounding parts; the inter-arytenoid region was granular and in a state of tumefaction; the superior opening of the larynx had an oval shape; the ventricular bands

were also granular and tumefied; the vocal cords were hidden from view. Upon the apex of the left lung there was noticed a slight dulness on percussion, and on auscultation a slight bronchial blowing murmur was revealed; there was also observed a slight depression of the infra-clavicular region. The skin was everywhere healthy. A *laryngo-pulmonary tuberculosis* was diagnosed, and the patient was ordered cold affusions in the morning, the internal administration of arsenic and creasote, local applications to the larynx of dilute lactic acid, and to observe the most rigorous hygienic measures. The pulmonary symptoms disappeared in a few days, but the condition of the larynx remained the same. Notwithstanding the absence of syphilitic history, and owing to the fact that the laryngeal affection proceeded from bad to worse, the patient was placed under anti-syphilitic treatment; but such bad results followed that the medication was suspended. The patient became weak, lost flesh, and his digestive powers were greatly disturbed. Ulceration soon appeared upon the larynx, the mucous membrane becoming the seat of round, hard, pale tubercles, most of them of the size of a pin's head. Sensibility remained normal, and I then diagnosed a *primary lupous laryngitis*. The internal administration of arsenic and creasote and the local application of lactic acid were resumed. The patient followed my advice very imperfectly, and thereafter I saw him only every two or three months. Circumstances did not permit me, as I desired, to place the patient under Koch's treatment. After a few months, *pari passu* with the progress of the laryngeal disease the pharynx and the fauces became involved. I scraped the diseased parts, but very little tissue could be obtained for microscopical examination; no bacilli were found. The uvula presented all the characteristics of lupus. Upon the tongue were observed, as if painted over it, smooth, rosy spots; the papillæ were considerably enlarged. The invasion of the fauces, the course of the malady, the peculiar form of the superior laryngeal opening, the aspect of the ulcerations and of the tubercles,—all, in my opinion, pointed to the existence of lupous laryngitis.

CASE III.—Carmen Zalamea, fifty-two years of age, of a marked lymphatic temperament, gave the following history. Her family has been apparently healthy. She had a son who died of consumption acquired while serving in the army. One of her sisters had an ulcer in one leg which never cicatrized. During her girlhood, and up to twenty years of age, the patient under consideration enjoyed perfect health. At the latter age there appeared upon her right cheek a hard, elevated, cord-like nodule, extending from the commissure of the mouth to the ear. This lesion lasted for two years, caused no inconvenience, and disappeared without any treatment. Soon afterwards, however, there came on an affection of the throat, which extended to the nose, and as a consequence of which she had dysphagia and dyspnoea, accompanied with loss of olfaction. This trouble likewise disappeared without any treatment. She menstruated at the age of sixteen, her courses having been regular up to six months ago. For the

last ten years she has suffered from her present ailment. It first began at the chin, and gradually extended to the lips, the right cheek, and finally to the throat. She suffers no pain, but has some difficulty in swallowing. Upon close examination, I found no vestige upon the surface of the skin of any previous disease, with the exception of a few cicatrices upon the nose and upper lip. The lower lip and the chin presented a soft, diffused, swollen condition, revealing to the touch the presence of hard, round nodules occupying the whole thickness of the true skin; sensibility was normal. The mucous membrane of the lower lip (which bulges out quite prominently) has a dark, rosy, bluish color, is soft to the touch, and covered also with nodules. These tumors are felt quite distinctly when the lip is held between the fingers. The epithelium is everywhere intact. A similar condition of affairs is found upon the mucous membrane of the right cheek, which is likewise covered with granulations. The uvula is enlarged and œdematous, and on its right border is observed a marked tuberculous nodule. All the soft palate appears twisted to the left, and when the tongue is depressed the uvula points towards the right anterior pillar, upon which there are noticed also some nodules. A quite large lobulated tubercle is likewise found on the right tonsil. All the functions appear to be normal. I diagnosed a *tubercular lupus of the chin, mouth, and throat*, and ordered the internal administration of tincture of iodine, iodide of sulphur, and acorn tea, together with the local application to the diseased parts of the iodated solution of Mandl. I likewise recommended the strictest hygienic measures. I have been cauterizing the granulations with the galvano-cautery. The patient appears better in every respect.

PART II.

LEPROUS LARYNGITIS.

Definition.—The changes produced upon the larynx as a consequence of the action of the leprous poison or matter constitute leprous laryngitis.

FREQUENCY.

The changes proper of the development of the leprous process are found only in common with other manifestations peculiar to the general disorder, manifestations which always precede the laryngeal affection. In other words, the laryngeal disease occurs with the same frequency as the general constitutional disorder to which it owes its origin.

The lesions of leprous laryngitis are as important as those of general leprosy, and yet few dermatologists and laryngologists have given the matter the attention it deserves.

Although I have consulted almost everything that has been written upon the subject, this article will contain mainly the results of my extended

personal observations. Leprosy is an endemic disease in Spain, especially at Seville, but, fortunately, this city possesses one of the finest leprosy hospitals in Europe, while its management, under the Sisters of Charity of the Order of Saint Vincent de Paul, could not be better. I shall therefore state, quoting the words of Sir Morell Mackenzie, that "my observations, whatever they may otherwise be worth, have at least this merit, that they are based on a larger and more varied clinical material than any of my predecessors has had to deal with."

As in the case of lupus, I cannot, in treating of leprosy, confine myself to the affection of the larynx alone, since the lesions more often than not, perhaps, invade at the same time the surrounding parts. In this article, therefore, I shall present leprosy of the throat, including therein that of the mouth, nose, pharynx, and larynx.

ETIOLOGY.

Among the principal predisposing causes of leprosy are inheritance; residence near the sea-coast or on the borders of great rivers; damp and marshy grounds; bad and insufficient food; uncleanness; low, dark, and dingy dwelling-places; poverty and misery; disregard for hygienic measures; previous disease; and cohabitation with leprous individuals. Men are considered more liable to leprosy than women.

The white race cannot, as asserted by Profeta, be considered predisposed to leprosy. In this I am sustained by the studies of Leloir, who has found that the Chinese, the Abyssinian, the negro, and the Mexican are as liable to be attacked by the disease as the Norwegian and the Spaniard. In Mexico the disease is more common among the aborigines than among those of European descent. In the leprosy hospital of Havana there were, in 1860, more negroes affected with the disorder than whites.¹

Several authors, notably Danielssen, Boeck, Mendez Alvaro, and Hernando, have affirmed that leprosy can be inherited. I myself had entertained the same opinion from the result of certain observations. Later studies, however, and especially the discovery of the *bacillus lepræ*, have convinced me of the erroneousness of this idea. I no longer, therefore, believe in the transmissibility of the disorder through inheritance, chiefly since many leprous patients belong to families entirely free from this terrible malady.

Danielssen and Boeck base their assertion upon familiar observations. Of one hundred and forty-five patients affected with tubercular elephantiasis at the St. George Hospital of Bergen, one hundred and twenty-seven had leprous relatives; of sixty-eight anæsthetic cases, fifty-eight showed antecedents of leprosy. Mendez Alvaro, in his statistics of ten provinces of Spain, corresponding to the years 1851 and 1852, records two hundred

¹ The common belief in Cuba is that the negro race is peculiarly predisposed to leprosy, and hence the leprosy hospital in Havana, which is certainly the best in the world, is sustained chiefly by the colored people through charitable contributions.

and eighty-four patients, of whom one hundred and nineteen had a leprous family history. Of the one hundred and thirty-seven cases collected by Hernando, seventy-four had a clear leprous family history, fifty-seven were free from it, and in five the disease was of doubtful origin. On the other hand, Leloir presents the following table :

Leprosy in Norway	57 cases :	33 had family history,	24 had none.
Leprosy in Italy	11 "	8 "	" " 3 " "
Leprosy in America	28 "	6 "	" " 22 " "
Acquired leprosy	11 "	0 "	" " 11 " "
<hr/>			
Total	107 cases :	47 had family history,	60 had none.

With respect to my own observations, I can show the following statistics. In private practice, out of nine patients, one had a leprous family history, six had none, and two were of doubtful origin. In the polyclinic, out of ten cases, only one had a leprous family history. In the hospital, out of thirteen patients, three had a leprous family history, ten had none. This gives a total of thirty-two patients, of whom only five had a leprous family history. This clearly shows that inheritance has nothing or very little to do with the production of the disease. There is also the fact that in many families the malady has first attacked the children and afterwards the parents.

A second factor which, in my opinion, disproves the transmissibility of the disease through inheritance, is the age at which it occurs. Hereditary disease may appear at any epoch of life, from birth upward. I have never read of a single instance in which the newly-born child was affected with the disease under consideration, as is of frequent occurrence, for example, in the case of syphilis. Of the one hundred and sixty patients reported by Leloir, whose ages were carefully investigated, in none did the disease in question appear before the fourth year. Mackenzie studied eighteen leprous patients, among whom not one was below six years of age when the malady made its appearance. The youngest of my thirty-two leprous patients began to suffer from the affection at ten years.

It is said that males are more predisposed to leprosy ; this agrees with my experience ; but this may be due to the fact that man is exposed to a larger number of exciting causes than woman is.

Many believe that residence at the sea-coast and on the margins of great rivers is a predisposing cause of leprosy. Although it is true that the inhabitants of the coasts of China, India, Persia, Arabia, Egypt, the Cape of Good Hope, Guinea, Morocco, Sicily, Southeastern Spain, Norway, Mexico, Guiana, and Brazil suffer from leprosy in the same manner as do those living on the margins of the Yang-tse-Kiang, Ganges, Nile, Niger, Volga, and Danube, of the St. Lawrence and the Plate, it is equally true that leprosy is found far away from the sea-coast and the borders of great rivers ; while, on the other hand, many river-margins and sea-coasts are totally exempt from the disease.

As to the character of the soil, leprosy prevails in dry as well as in marshy, damp districts ; and where the malady is endemic, it attacks those living in the mountains as well as those inhabiting the lowlands. If elephantiasis appears to be more frequent in maritime cities, it is due to the fact that in these the population is comparatively larger than in the interior towns, and more under the influence of commerce and general traffic.

It has for a long time been thought that the use of certain articles of food predisposes to the development of the disease. Pork, blue-fish, salt fish and smoked meats, spoiled milk, bad water, poor wines, all have been thought to produce it. Certain facts, however, do not sustain this theory. Leloir tells us that the Norwegian fishermen use decomposed fish, bad milk, and other spoiled articles of food, eat largely of white potatoes, oat bread, and salt lard, drink brandy and impure water, water which is kept in pools, many of these being in the immediate vicinity of privies, and yet are not peculiarly prone to suffer from the ravages of the constitutional disorder. It is only the fishermen inhabiting the western portion of Norway who are attacked by leprosy ; those living in the north and in the south of the country, although surrounded by similar circumstances, subject to the same hardships, following the same modes of life, especially as regards alimentation, are free from the malady. The fishermen of Terranova and other Italian sea-coast towns are almost exclusively ichthyophagous in their diet, and yet they do not suffer from elephantiasis. The inhabitants of the Riviera, who occupy a very salubrious country and who are scrupulously clean in their persons, have plenty of fresh air, do not eat fish, make large use of vegetables, fruits, and grits, are, on the contrary, predisposed to leprosy. The same thing may be said of the inhabitants of the province of Andalusia in this country (Spain). These people use pork largely. Of my thirty-two patients, ten had been in the habit of taking large quantities of oil. Nevertheless, this consideration is of no value, since many of those who use oil to a very large extent are never attacked by the disorder.

Insufficient amount of food cannot be considered a cause of the disease in question. Leloir says that no other peoples are so poorly fed as the aborigines of Australia and the Indians of North America, and yet they do not suffer from leprosy. I may remark, too, that the inhabitants of no other city are more abundantly fed than those of Seville, and yet among them we find victims of the terrible disorder.

It has been held that excessive work is a cause of leprosy. Be this as it may in other countries, I know that the indolent Mexican and the lazy Andalusian are not exempt from the leprous affection. Again, the houses of these patients, especially in this region of the country (Andalusia), are low and badly ventilated, it is true, but, on the other hand, the inhabitants spend most of their time out of doors, and thus receive constantly the benefit of abundant pure air and sunshine. Abuse of alcohol is the only great fault of the Andalusians ; and yet, of all my leprous patients, only *one* was an alcoholic *habitué*, the rest had led a life of temperance.

From the remotest periods of time leprosy has been thought to be highly contagious. We are all familiar with the Hebrew law in regard to the disease. Leprosy inspired such a terror in the Middle Ages, and particularly during the time of the Crusades, that patients were shunned, cast away, torn from family and friends, and condemned to solitary confinement far out in the fields. Hospitals built in isolated places, devoted especially to receive leprous patients, came afterwards into play. In the course of time, however, fears were dispelled regarding the contagiousness of the disease, for it was found that, notwithstanding the cohabitation of healthy and affected individuals, there was no tendency to a spread of the malady. The laity and many physicians, from these observations, finally arrived at the conclusion that leprosy was not contagious. Such was the opinion of Danielssen and Boeck, sustained by Bazin and by Olavide. The discovery of the *bacillus lepræ* by Armaner Hansen, however, revived the theory of the contagiousness of the disorder. Mendez Alvaro, out of the two hundred and eighty-four cases already referred to, ascribes the origin of the disease to contagion in twenty-six. Leloir, from his own observations made in Italy, believes the malady to be contagious. Cornil reports the case of an employee who contracted the disease from using the furniture of an individual that had died of leprosy. From a geographical and historical study, Leloir has drawn the following conclusions: 1. Leprosy has had a primary focus, from which it has spread all over the world. 2. Leprosy has appeared among the inhabitants of a country when taken there by strangers suffering from the disease. 3. A nation has known the disease only when relations have been established with another nation in which the malady prevailed, no matter to what race the inhabitants belonged. 4. Climate and hygiene exercise no influence in the production of leprosy. 5. In some instances the invasion of a country by leprosy has been so rapid that the theory of inheritance alone could not explain its appearance. 6. The propagation and development of the disease are in inverse ratio to the isolating measures employed by infected countries.

Kaurin, director of the leprosy hospital at Keknaes, in Norway, cites forty-eight cases to prove the contagiousness of leprosy. The families of these patients had no history of leprosy, the disease coming on after contact with individuals suffering from it. Kaurin believes that it is quite difficult to find a leprous patient lacking a history of previous contagion.

Profeta admits inheritance but opposes contagion as a cause of the malady. He speaks of many instances where leprous women have nursed their own and other children without transmitting the disease. He cannot remember a single case of leprosy occurring among physicians or nurses who have for years attended leprous patients. Mendez Alvaro, after referring to cases favorable to contagion, cites twelve married couples and two widowed persons who never contaminated their respective husbands or wives. Hernando considers the non-transmissibility of the affection of great significance, but does not think the question yet solved. Similarly, Gam-

berini bases upon his numerous personal observations his belief in the non-transmissibility of leprosy.

Of my thirty-two patients, one said that her husband had a leprous brother with whom they were in constant contact. The rest, with the exception, perhaps, of the five who had leprous relatives, had never even heard of the disease until it attacked them. All these continued to live with their families (in Spain the law does not oblige this class of patients to live in the hospital, nor do the people shun them), and yet not a single case of leprosy occurred among their relatives or friends with whom they mingled. The San Lázaro Hospital, of Seville, founded in the thirteenth century, does not record a single case which can be ascribed to contagion among the physicians, nurses, or other individuals that have been connected with the institution. I must here call attention to a curious and highly-interesting case. A Sister of Charity, a private patient of mine, is the only one that appears to have been radically cured by me of the terrible affection. The cure was effected three years ago. The lady still continues to live in the hospital, attends devotedly and constantly to leprous patients, and nevertheless to the present time has remained entirely free from the disease.

To all these facts bearing on the non-contagiousness of the disorder under study, Profeta, Gamberini, Hardy, and Campana add that it has not been definitely established that the bacillus of Hansen is the true cause of leprosy, and that, even if it were, it does not warrant the conclusion about the existence of contagion. Again, according to the repeated experiments performed by Profeta upon the lower animals, and upon human beings, including himself, it is impossible to produce leprosy by inoculation.

On the other hand, the fact exists that traumatic injuries have originated the disease. I could cite many cases of this nature, but I shall refer only to those reported by Abraham.¹ A European received a wound upon a finger; this became swollen, suppurated, but never healed up, and soon afterwards leprosy appeared. An inmate of the Tarn-Tarn Asylum, in the Punjab, cut himself on the buttock with a sharp stone; an ulcer resulted, which did not heal in four years; the surrounding part became insensible; small blisters then appeared in other portions of the body, and soon afterwards there occurred atrophy of the fingers and an anæsthetic condition of the extremities. The beginning of the malady in two other cases in the same institution was referred to simple fissures of the feet; and in still another case the disease began in a lesion of the thumb, said to have been produced by a snake-bite. According to Abraham, Filipo published a famous case occurring in a young man who was entirely cured after a five-year treatment. The patient, while bathing, was cut in one toe; the wound was converted into an ulcer which resisted all treatment; the toe was swollen and painful for two years before the appearance of the constitutional disease. May not these cases, asks

¹ London Lancet, May 24, 1890, p. 1143.

Abraham, have been due to possible inoculations through a denuded surface?

As the matter stands, the question of the contagiousness or non-contagiousness of leprosy cannot, as yet, be definitely settled.

SYMPTOMATOLOGY.

The Italian writer Masini says, "Owing to its delicate structure, with a mucous membrane covered in its largest portion with cylindrical epithelium, and with its numerous folds; owing also to the flexibility and adaptability of its cartilages, to the abundance of adenoid tissue in which are embedded numerous follicles and glands, and to the richness of the lymphoid structure, the larynx is especially predisposed to be invaded by leprosy." This is true, but the disease never appears upon the larynx primarily. It usually attacks this organ after it has invaded the skin, mouth, and fauces. All authors are agreed on this point; but there is a difference of opinion as to how soon after the primary general disorder the local laryngeal affection appears. Masini believes that leprous laryngitis comes on in from four or five weeks to three months after the primary manifestation. Kaposi thinks that the local disorder appears only after many years of the existence of cutaneous leprosy. Both these authors are right. In the experience of Mackenzie, out of ten cases, in nine the appearance of leprous laryngitis as a secondary manifestation varied from two to ten years; in only one patient did the local trouble come on *pari passu* with the general disorder. My own statistics show that the period varied from six months to ten years; in one of the cases the local and the general trouble appeared at the same time. I do not, however, rely on these figures, because patients have been unable to tell me, with any exactness, the time at which they began to suffer from the laryngeal affection after the first appearance of the constitutional malady. One of my leprous patients, whose mouth, fauces, and larynx were covered with spots, tubercles, and ulcers, assured me that there had never been anything the matter with his throat. He was probably unaware of the presence of the disease in the early stages because of the characteristic insensibility caused by leprosy.

The first alterations produced by the laryngeal trouble appear sometimes on the soft palate and the uvula, from which the disease extends to neighboring parts; at other times the first signs are observed on the nasal mucous membrane, and by continuity or by new patches the disease soon after invades other parts of the mouth and throat. This early inflammation of the mucous membrane is the true cause of the change in the voice and of the shortness of breath experienced by leprous patients. The dysphonia and the respiratory trouble are not caused by the changes produced in the larynx and in the lower respiratory tract which are affected late. The voice is not hoarse, but nasal, and the breathing through the mouth is free. There is no true dyspnoea, but a sense of fatigue and some difficulty in speaking are experienced by patients on exertion. The hoarseness of the voice, the

aphonia, and the difficult respiration are observed only in the advanced stages of the disease, and in many cases such symptoms are never noticed, owing to the fact that death occurs before the larynx is profoundly affected.

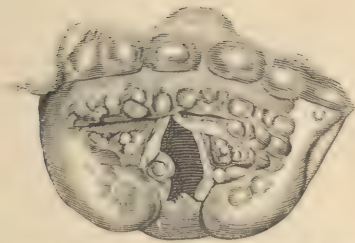
Let the origin of the laryngeal disorder be what it may, the first symptoms exhibited by patients are dryness and a sense of tickling in the nose, pharynx, and larynx, producing sneezing, sore throat, and cough. Frequently there occurs abundant and repeated epistaxis. The congested mucous membrane appears then of a rosy red or livid hue, and may become so infiltrated and tumefied that it may occlude the nasal fossæ, the nasopharyngeal space, or the laryngeal cavity; the lips become prominent and thick; the tongue becomes enlarged; the epiglottis acquires the aspect of an œdematous prepuce, or that of a pig's snout, and the interior of the larynx a funnel shape. I have seen the superior opening of the larynx completely closed by the thickened ary-epiglottic folds. I saw a patient in the San Lázaro Hospital whose lips were four centimetres in thickness; the gums of another patient presented the appearance of two rows of chick-peas; other patients had enlarged uvulas, and in still other cases the epiglottis was so enlarged and thickened that I could not see anything underneath it. This enormous thickness of the epiglottis has been observed by Kalindero, Babés, Ruault, and Mackenzie.

The consistency of the tumefied parts or tissues is at first hard, but it soon becomes of a soft nature, pitting on pressure, as happens in the case of œdematous tissue.

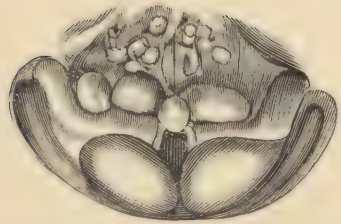
During the first days of the disorder sensibility remains intact, and the patient merely experiences disagreeable sensations of tickling when the diseased part is touched. These sensations, always slight, soon disappear, and sensibility to touch is lost, the parts becoming completely anæsthetic. This allows a thorough examination of the larynx and nasopharyngeal space at a time when, under other circumstances (especially in a healthy individual), it would be impossible. If leprous patients sometimes resist an examination of the throat, the difficulty must be ascribed to the fact that some of them cannot breathe easily during the examination.

The color of the mucous membrane, which is uniform at the beginning, varies with the progress of the disease. The change does not take place at once, so that the membrane exhibits a spotted appearance. These rosy spots appear more prominently upon the soft palate and on the anterior face of the posterior wall of the pharynx. The pillars of the soft palate, especially the posterior ones, have a marked brown color. In the course of time the spots disappear and the mucous membrane assumes a pale hue resembling that of the palate and larynx of phthisical patients, which has been so admirably described by Isambert.

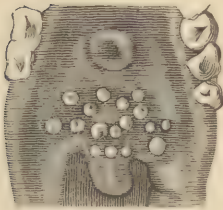
During the *congestive* period the membrane is dry and glossy, as if covered with a coat of varnish. On the disappearance of the congestion there is a detachment of the superficial layers of epithelium, and the membrane



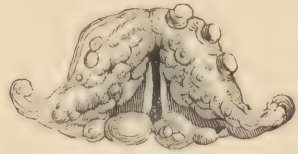
Large, thick, and congested epiglottis, drawn backward by lepro-tubercled masses; enlarged arytenoids.



Tumefied epiglottis hanging over glottis; enlarged and congested ary-epiglottic folds and ventricular bands, covered with large and small leprous tubercles.



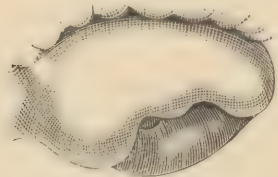
Leprous tubercles on the hard palate and velum (Leloir).



Enlarged and thickened epiglottis, with rounded edges curled inward, towards each other, the whole pale-grayish in color; on the upper margin were yellowish tubercles (Mackern).



Leprous tubercles at base of tongue, on the epiglottis, left vocal cord, and cartilages of Wrisberg (Wagner).



Leprous distortion of larynx (Lennox Browne).

becomes of a pale color. If the infiltration has not been reabsorbed, nor desquamation taken place, the membrane exhibits an appearance, according to the happy description of Mackenzie, as if it were infiltrated with suet. When reabsorption, not only of the exudate, but also of a part of the cellular elements, takes place, the membrane appears pale, thin, rigid, and but little sensible; in other words, a true leprous sclerosis is produced.

The *second* period of leprous laryngitis is characterized by the appearance of the tubercles. These tubercles are of a dirty white or opaque yellow color; they vary in size from that of a pin's head to that of a small pea; they are numerous, occur all over the membrane isolated or in groups, are sensitive at first, but afterwards become entirely painless.

On the appearance of the leprous nodules the uniform swollen condition of the membrane disappears, and over the latter are observed, here and there, superficial tubercles of the size of a hemp-seed, having the same color as that of the membrane. In some cases these tubercles remain stationary for years; in other instances they grow, change in color and consistency, and soon either end in resolution or ulcerate. As a rule, they grow slowly, and after they have attained a certain size they become stationary, diminishing afterwards gradually until they disappear, or else they break and ulcerate. From the fact that not all the nodules appear simultaneously, their size and color change considerably. Examination of the throat of a leprous patient, however, reveals a large number of yellowish-white nodules which appear in groups, in irregular, circular, or half-moon-shaped patches, or in chains resembling a rosary. The same disposition is exhibited by the rosy red or violet-colored tubercles. These nodules are round, conical, oval, lenticular, or spherical in form; their base is broad in relation to their height, and their largest size is that of a pea or of a hazel-nut. I have never seen tubercles of greater dimensions than these; and although some authors, especially Hillis, assert that they have seen them as large as a chestnut and even a hen's egg, I believe such writers have had in mind either cutaneous tubercles or else patches or groups of the latter, like those described by Leloir. The tubercles, hard at first, soon become soft and give to the touch the sensation imparted by the mucous membrane of the lips in a natural state. Sensibility remains intact for a long time, but is gradually and finally lost entirely. Some leprous patients, although they have not been able to feel a red-hot iron applied over the tubercles, have assured me that their sense of taste was perfect, and that they could enjoy a good cigar. I must say, however, that in my experience anæsthesia is generally greater than analgesia. Patients unable to feel the contact of any object will complain of pain when pressure is made upon the patches or when these are pricked by a pin. Taste is generally unaffected. Such is not the case with the senses of hearing, sight, touch, and smell, all of which, especially the latter, are more or less blunted and sometimes completely destroyed. The imperfect olfaction and the nasal character of the voice can be easily explained by the condition of the whole

mucous membrane of the nose and pharynx. The tubercles in the nose not only interfere with smell, the voice, and the respiration, but may even markedly alter the shape of the olfactory organ. The transverse diameter of the nose may equal or even exceed the antero-posterior diameter; this circumstance changes the nasal openings to a round form, and gives to the face a peculiar idiotic or stupid expression.

Upon the tongue the tubercles appear in the form of papillary vegetations or polypoid tumors, and are separated by transverse and longitudinal furrows. It is upon this organ that I have seen the individual tubercles acquire the largest proportions.

Tubercles are similarly found in the form of patches over the membrane of the palate, especially upon the middle portion, from the incisors to the uvula. Near this appendage, on both sides, the tubercular masses may assume a large size, and if the little organ happens to be atrophied, as is often the case, the peculiar appearance of three uvulas is exhibited. The nodules observed over the organ of the voice often give origin, as I have already stated, to hoarseness, aphonia, and dyspnoea. These tubercular bodies are frequently met with on the ary-epiglottic folds, quite rarely on the ventricular bands, and may even invade the inferior vocal cords. Those I have seen here are round and flat, whitish or reddish, situated some upon the surface, others upon the borders.

"The *third* period of leprous laryngitis is characterized by ulceration of the tubercles and deformity of the part affected. The ulcers appear upon the tongue, soft palate, pharynx, and larynx; they are of a roundish form, elevated above the surrounding tissue, and resemble very much syphilitic mucous patches. Sometimes these ulcers have prominent, white, pale borders, a smooth or finely granular fundus, more or less excavated. The lesions appear first upon the palate, then on the uvula, the palatine arches, the pharynx, and finally the larynx. The destructive changes produced on the epiglottis, ary-epiglottic folds, and the arytenoid cartilages give to the superior laryngeal opening a round form. The ulcerated and tumefied bands cause stenosis and hide from view the vocal cords, but when these are examined they are found corroded, deformed, and slow in their movements. Dysphonia is now quite marked; the fetor of the breath unbearable. In the course of time, pieces of cartilage are expelled in the expectoration, and then aphonia is complete. While some ulcers increase in size, new ones appear; but some of the old ones disappear, leaving behind white cicatrices which cause deformity of the part and complete loss of sensibility." This paragraph, written ten years ago, was embodied in a work which I read before the International Medical Congress held at Seville in 1882. What I then said cannot be greatly modified at the present time. Nevertheless, I must to-day declare that ulcerations of the larynx are exceedingly rare, and are so late that usually patients die from the general effects of the malady before such lesions appear. What I asserted ten years ago was due chiefly to the fact that I then saw in the

Leprosy Hospital of Seville two cases, in both of which the larynx was horribly mutilated. They were the same two patients examined by Mackenzie, and both have since died.

In the nose leprous ulceration makes terrible havoc. The tubercles developed upon the nasal mucous membrane are the first to ulcerate, and the changes produced in this region may be such as completely to obstruct breathing through the nose. An interesting case of this nature is reported by Wagner.

A serous or mucous and bloody liquid of an offensive odor is constantly running from the nose; on blowing hard through this organ, liquid or coagulated blood, hardened mucus, and pieces of membrane, cartilage, and bone are expelled. The work of destruction continues, and gradually the septum, the bridge, and the alæ of the nose disappear. The loss of the bridge gives to the face a peculiar expression, thought to be characteristic of this disease. Finally the whole organ is destroyed. The typical deformity of the nose, due to the loss of the bridge, has been observed by Mackenzie in the Central Hospital of Norway. Ruault has noticed perforation of the cartilaginous portion of the septum. Leloir has described similar lesions of the nose, and believes, likewise, that it is in this organ that ulceration appears first.

After the nose, the part most frequently affected with ulcers is the soft palate, then the uvula, which may be partially or totally destroyed. The ulcers of the palate, though rarely, may, according to Plumert, cause perforation of the part. I have seen upon the palate, uvula, and tongue white ulcers resembling a diphtheritic patch, and others of a similar nature resembling in color those of *muguet*.

The lesions upon the tongue, in the description of which I agree with Leloir, are frequent, appearing particularly on the dorsal side and borders of the organ. Upon these parts only pearl-like patches are seen sometimes; at other times, deep longitudinal and transverse furrows are observed. The lobules are generally hard, of a sclerotic consistency, of smooth surface, and of a grayish or pearl-like color, the epithelium being quite hypertrophied. Kaposi has noticed upon the back of the tongue opaque epithelial patches which have been transformed into true crusts, separated by deep longitudinal and transverse grooves. This grayish epithelium is easily detached and is constantly being regenerated; hence its different colors, appearing sometimes as if it had been touched with nitrate of silver. On the other hand, Taylor has observed ulcers on the tip of the tongue, and Ruault has seen upon the left side of the organ, near the border, two superficial white ulcers, forming quite a contrast with the rest of the lesions, which appeared of a yellowish color. Ulcers are similarly observed upon the gums and upon the mucous membrane of the lower lip.

I have never seen these lesions upon the buccal pharynx, but Mackenzie has noticed them covering not only the sides but the whole of this organ. Leloir, likewise, speaks of rosy ulcers of the pharynx, which heal rapidly

to reappear later. Neither Masini, Hillis, nor Kaposi affirms to have ever seen leprous ulcers upon the larynx.

According to Masini, a leprous granuloma rarely gives origin to necrosis and laryngeal ulcers, owing to the fact that that process is accompanied by a development of blood-vessels which is sufficient to nourish the new tissue; hence the epithelium is not affected, even if underneath it is found an abundant infiltration. I agree with this author, for, with the exception of the two cases already referred to, I have never seen ulceration of the organ of the voice. Other writers, however, notably Kalindero and Babés, have observed ulcers on the larynx of several patients in whom they have had occasion to study the effects of tuberculeine. Ulcers of the epiglottis and vocal cords have also been noticed by Gibb. Mackenzie, Taylor, and Wolf, quoted by Tobold, have made similar observations, as have, likewise, Ruault, Zwillinger, Plumert, Gottstein, and Hernando. It is, therefore, seen from this that leprous ulcers occur upon the larynx sometimes, and are produced by a leprous infiltration, notwithstanding the numerous vessels which, according to Masini, are found in the granuloma.

The larynx may be greatly deformed. In two of my cases (hospital patients) I found the cartilages, especially the thyroid, enormously enlarged; the thyroid, however, did not present the peculiar form of a crustaceous skeleton, as pointed out by Isambert, and which is so frequently observed in laryngeal cancer. In both patients the larynx was very large, and I may say that if it could have been measured externally the antero-posterior diameter would have given, at least, a length of ten centimetres. In the first patient the form of the larynx was that of a cylindrical tube, perhaps a little wider at the top than at the bottom, round, and convex on both sides. That of the second patient resembled the breast of a fowl, with a rather prominent keel. Both organs exhibited an ossified consistency, resisting pressure considerably. This condition did not correspond with the ages of the patients.

It has been said that the anæsthetic form of the disease does not occur in the throat. I cannot agree with this opinion. It is true that I have not seen the characteristic pemphigoid phlyctenulæ on the mucous membrane of the mouth, pharynx, and larynx, but I have seen other alterations, examples of which I give in my tables. The anæsthetic leprous patient exhibits a notable paleness of the mucous membrane, a thin, tense, and paralytic condition of the palatine vault; the arches are of a violet hue; the uvula is pale and œdematous, the epiglottis thin and rigid. In other words, in these cases all the tissues are anæmic and atrophied, insensible and paralytic, as neither on the soft palate nor on the pharynx can reflex movements be provoked. In one of my patients the paleness, atrophy, insensibility, and paralysis of the palate, pharynx, and larynx have been quite marked. In view of these facts, we cannot deny the existence of the anæsthetic form of leprosy of the throat.

MARCH, DURATION, AND TERMINATION.

Leprous laryngitis exhibits in some cases a continuous course, in most of them an intermittent one, and in all it is developed in a slow, gradual manner. The lesions, whether on the mucous membrane or on the skin, come on in successive crops, and between the appearance of one of these and that of the following one the phenomena remain stationary. Some of these lesions are slow, others more or less rapid, in their course, and thus it happens that in the same region may be observed at the same time tubercles, spots, and ulcers in different degrees of development.

Although leprosy of the throat is a chronic process, the nodules here come on and ulcerate sooner than in the cutaneous disorder. When ulceration has been established it may last for months or years, invading all the tissues of the part affected. It has been said, however, that ulceration is rarely found upon the larynx, that it is more or less superficial upon the tongue and the soft palate, and that the most destructive changes are met with in the nose.

As I have already intimated, leprosy of the throat, like that of the skin (with few exceptions), may last for months or years, or during a whole lifetime. Like the lesions of other parts, those of the throat have, individually considered, their periods of birth, development, and death, and when they disappear they leave behind permanent cicatrices. If, as sometimes happens, all the lesions disappear simultaneously, the patient remains for a shorter or longer time apparently cured. After a few months, however, the eruption reappears, showing that the cure had not been a radical one. At other times, while some symptoms disappear, those remaining persist for a long time. Following these temporary ameliorations, a recrudescence takes place, and thus the intermittent type of the disease is made manifest, lasting during the life of the patient. Cures, although exceedingly rare in leprosy, have been observed; but the exceptions are so numerous that it may be set down as a rule that the malady terminates only with the life of the patient.

PATHOLOGICAL ANATOMY.

An examination of a leprous larynx reveals a diffuse tumefaction of the mucous membrane, especially of the supra-glottic portion, due partly to an infiltration of the leprous matter, partly to oedema, and partly to an increase of the connective tissue. This swelling produces a diminution in size of the laryngeal cavity and of the superior opening. Cases in which enormous infiltration of the parts under consideration has occurred have been reported by Thin and Virchow.

This infiltration, which, according to Virchow, is made up of granular tissue, is in some parts of a diffuse and in others of a nodular nature. In the first instance the surface of the mucous membrane is smooth, pale or of a dirty grayish color, and dry. In the second instance the membrane appears granular, covered with small, pediculated vegetations, so numerous

sometimes as to produce, according to Leloir, a *velvety* aspect. The infiltration is most abundant upon the pharyngeal pillars of the soft palate, especially so upon the epiglottis, the ary-epiglottic ligaments, the arytenoid cartilages, and the ventricular bands. The swelling produces a complete deformity of the part and gives to the tissues a specific hardness. Leprous infiltration presents itself under two anatomical phases: one characterized by a large accumulation of cells in the connective tissue, this being ultimately supplanted by those elements; and the other by the presence of cells in the meshes of a very fine fibrillar tissue.

The infiltration is made up of round, fusiform, or star-shaped cells; the large majority of them exceed in volume the red-blood disks, some of them attaining the size of mucus-corpuseles. These bodies are thought by Thin to be leucocytes, white-blood cells, which have wandered out of the vessels, and which seem to enhance the development of leprosy. Such cells have usually one nucleus, although, especially in old tubercles, they may have two or three nuclei. Virchow speaks of leprous cells, true giant cells, having several nuclei and the vacuoles of Neisser. According to Leloir, these leprous corpuseles are not always cells; they are sometimes zoöglœa of bacilli.

When stained by the process of Cornil, of Ehrlich, of Babés, or of Unna, the cell is found to be full of bacilli, of the form of a thin rod with, sometimes, pointed extremities; the cell in length is from one-half to three-fourths the diameter of a red corpusele, and in width from one-fifteenth to one-eighth of the same diameter. According to Neisser, Hansen, and Cornil, the bacilli have several nodular dilatations, which, especially those found at one or both extremities of the bacillus, are, in the opinion of Leloir, made up of true spores. The bacilli having three or four dilatations are larger than the ordinary ones. Sometimes large, articulated filaments are seen, which appear to be bacilli united at the ends, forming chains or rosaries. Neisser speaks of a kind of mucilaginous zone surrounding the bacilli, which is quite distinct in stained preparations. The power of resistance in the bacilli is very great: Leloir says that Kobner found myriads of them in a fragment of a leprous nodule ten years old. The bacilli are also met with in mucus, saliva, and pus. According to Hansen, Cornil, and Leloir, the spontaneous movements of the bacilli can be observed by adding a drop of water to a preparation.

The pavement and cylindrical epithelium remains intact in the lower portion of the larynx; but in the superior part of the organ, as well as in those places where the infiltration is large, the nuclei of the cells lose their characteristic form, and appear in segments or in half-moon-shaped bodies, the protoplasm being less granular. Bacilli are rarely found in the epithelium; Masini doubts their existence here. They are numerous, however, between the epithelium and the papillary layer of the dermis, where the infiltration is quite abundant.

The greatest changes are observed in the sub-epithelial tissue. The

papillæ are thicker and deeper. The dermal tissue is swollen up by the diffuse or nodular infiltration, which, collected and liberated in the connective tissue, or covered by a reticular stroma, or arranged in stratified layers, constitutes the leprous neoplasm. This growth has a slow but decided tendency to ulceration. The whole thickness of the mucous dermis of the tongue is infiltrated by this neoplasm, which similarly penetrates the subdermal tissue and the laryngeal muscles, whose fibres are stretched, separated, and destroyed. The papillæ are sometimes flattened; some are hypertrophied and some have entirely disappeared. A section of an infiltrated tissue exhibits the characters of a sclero-gumous laryngitis, contains many leprous cells, is but slightly vascular, and has a tendency to fibrous degeneration. A caseous change may also occur, and in such cases the superficial ulcers resulting resemble very much the tubercular lesions. The enormous swelling of the laryngeal mucous membrane gives to the organ of the voice the deformities of which I have elsewhere spoken; the stenosis may become so great as to call for tracheotomy. The laryngeal muscles, like those of the tongue, are invaded by the leprous matter, softened, and finally disintegrated. The same may be said regarding the nerves, which explains the paralysis observed. The changes here resemble those taking place in the glands. Masini found leprous cells among the nerve-fibrillæ, but noticed that the large trunks, especially the superior laryngeal, were entirely free from infiltration. This may have been due to a peculiarity of the individual case, as generally in the leprous larynx are noticed the analgesia, the anæsthesia, the paresia, and the paralysis met with in other parts of the body. The leprous corpuscles pressing upon the blood-vessels produce obliteration of these, and hence the anæmia, the paleness, of the diseased mucous membranes. Some authors believe that, owing to the absence of blood-vessels in the cartilages, these are not invaded by the leprous infiltration; yet Leloir and Neisser have found bacilli in the cartilages, either in a free state, between the cartilage cells, or within these beside the nuclei.

A section of a leprous nodule under the microscope exhibits several zones, especially a central one of a yellowish-gray color, surrounded by another of a brownish hue, and this by a third having a reddish coloration. From the surface of the cut nodule there exudes a red, viscid liquid composed of more or less altered blood-corpuscles, numerous lymphatic cells, and a certain number of round bodies which contain the bacilli. The blood-vessels appear dilated, the walls thickened, especially the external coat; but when the internal coat is similarly affected, the calibre may be so diminished in size as to be completely obliterated. Leloir says that lepromas contain many dilated vessels filled with the coloring matter of the blood; that in the course of time a part of the leproma is reabsorbed or eliminated and part becomes sclerotic, or, better still, that the surrounding tissues become sclerotic.

DIAGNOSIS.

From the fact that lesions of leprous laryngitis come on after the appearance of the general disorder, the diagnosis of the local malady is easy to make. The symptomatology of the constitutional disease alone is sufficient to indicate the character of the existing laryngitis. However, it is important to distinguish this local disorder from others with which it may be confounded, such as lupus, cancer, syphilis, and tuberculosis.

Lupus may come on primarily, and, therefore, in a given case, the absence of cutaneous lesions is a sufficient diagnostic point. The leprous tubercle is always preceded by a reddish coloration, which afterwards turns white; the lupous tubercle is developed upon a mucous membrane that generally exhibits its normal characters throughout. The leprous tubercles are white, soft, variable in size, appear in the form of a chain or a rosary, and their sensibility may be normal, diminished, or entirely abolished; the lupous nodules are of a rosy or reddish hue, hard, resistant, and elastic, larger in size than those of leprosy, generally indolent, but their sensibility remains normal. Leprous ulcers are superficial, with indistinct edges, and suppurate but little; those of lupus have hard, elevated borders, and a narrow and sinuous fundus, and their secretion is abundant. The cicatrices in both affections exhibit a similar general aspect, but those of leprosy are insensible, while those of lupus retain the normal sensibility peculiar to the part affected.

Cancer also appears upon the larynx primarily, the skin remaining intact. Cancer and leprosy are preceded by a great congestion of the mucous membrane, but the color of this varies in both cases. In that of the first disease it is bright red, carmine, or cherry-red, disappearing on pressure; in that of the second, it is dark or grayish red and does not wholly disappear on pressure. In cancer the coloration remains; in leprosy it is changed into a marked paleness. The tubercles of cancer are rosy, reddish, or grayish; those of leprosy are dirty red, whitish opaque, and yellowish. The cancerous tubercles are hard at first, but become soft afterwards, and the seat of lancinating pains; those of leprosy are soft, pediculated, and may be totally insensible. The leprous, superficial, dry ulcer forms a marked contrast with the wide, deep ulcer of cancer, this having hard borders and irregular fundus, and giving rise to a sanguinolent ichorous secretion. In both affections the thyroid cartilages may become deformed, but in leprosy I have never seen the peculiar tortoise-shell shape of these cartilages pointed out by Isambert as existing in cancer.

Though syphilis may usually be recognized without much difficulty, yet there may be cases in which a recognition will not be easily made out, for laryngeal lesions may exist in a leprous patient without, apparently, a history of the former constitutional disorder. Sometimes the resemblance between syphilitic mucous patches and leprous ulcers is quite marked, but the coloration produced by syphilis, although dark reddish, copperish, is

not the grayish red that we observe in leprosy. Again, the anæsthesia noticed in leprosy patches is easily differentiated from the hyperæsthesia of the syphilitic lesions. Secondary syphilitic ulcerative manifestations are mere erosions, while those of leprosy, though superficial, are true ulcers. The ulcers of tertiary syphilis are more rounded, deeper, and more prominent than those of leprosy; besides, these latter are generally surrounded by an inflammatory areola when found upon a pale, anæmic mucous membrane. Syphilitic lesions have a comparatively rapid course and are modified by anti-syphilitic treatment, which is useless and often injurious in leprosy disease.

Tuberculosis appears upon the throat after a pulmonary invasion; similarly, leprosy is secondary only to the cutaneous manifestation. Even when tuberculosis of the larynx is of a primary nature, it soon invades the lungs, the changes produced in these being detected by auscultation and percussion. Tubercular ulcers are first seen on the vocal cords, then over the inter-arytenoid space, and lastly on the epiglottis; just the opposite of what happens in leprosy. Tubercular ulcers are multiple, small, irregular, with a dirty-grayish or granular and elevated fundus and a limited areola. Leprous ulcers are usually simple, extensive, covering a whole region or part of the organ, without a red areola, and are seen most commonly in extremely pale tissues. Tubercular ulcers are painful; those of leprosy are indolent. The bacilli of tuberculosis penetrate, from the start, into the endothelial cells of the lymphatic vessels, and then into the leucocytes; those of leprosy invade especially the fixed cells of the connective tissue. The bacilli of the former disease are rare, and generally only one is found in each cell; those of the latter affection are ordinarily observed in compact masses, constituting the protoplasm of the cells. The tubercle-bacilli are propagated by the lymphatics and in the direction of the blood-vessels; the leprosy bacilli are propagated in the direction of the tendons and nerves. The tubercle-bacilli are more rapidly developed in the tissues than those of leprosy, and their elimination is likewise more prompt, owing to three factors: 1, they are met with in isolated parts or included within the leucocytes; 2, the tubercular product is found in tissues which facilitate its expulsion; 3, the destruction of tuberculous nodules aids in the elimination of the bacilli. The number of bacilli found in tubercular products is less than that observed in leprosy lesions. The tubercle-bacilli, even when mostly disseminated, remain for a long time limited to tubercular products; those of leprosy have a tendency to propagate themselves through the whole organism, being found even in the perithelial or plasmatic cells of healthy or slightly affected organs. Such are the differences between the bacillus of tuberculosis and that of leprosy, as pointed out by Kalindero and Babés.

PROGNOSIS.

The prognosis of leprous laryngitis, whether the disease be considered by itself or viewed as a secondary manifestation of the general disorder, is always grave. The malady has no tendency to a spontaneous cure, nor is there a remedy of sufficient power to stop its course, and it is as much dreaded to-day as it was during the Crusades or even in the times of Moses. Since the disease has resisted all treatment, Lennox Browne and Leloir consider leprosy as of purely speculative interest, since the disorder always terminates in the death of the patient. The latter author attaches no importance to what he calls pretended cures of Campana, Unna, etc. I confess that leprosy nearly always terminates fatally; but I do not entirely believe in the inability of patients to get well of the terrible scourge; and I claim to have completely cured one patient, the history of whom I shall give later, in the section on treatment. I cannot, therefore, deny the cures affirmed to have been effected by Campana, Unna, and Fox.

Leprous laryngitis may be fatal on account of the changes produced in the organ of the voice. Lennox Browne speaks of deaths having been produced by œdema of the glottis; but this, I believe, must be quite rare, since in all my patients suffering from the leprous malady I have never noticed difficulty in the respiratory function.

TREATMENT.

All authors agree that there is no remedy sufficiently efficacious to combat leprosy; at the same time, all agree also that hygiene exercises the most beneficial influence.

The first thing to be done in a case of leprosy, especially when the disease is of an endemic character, is to change the surroundings; unfortunately, however, this is not always practicable, owing to the fact that leprous sufferers generally belong to the poorer classes of society. The dwelling-places of such patients must be located far away from crowded centres of population, from great rivers, from lowlands, the principal object being to avoid dampness and to enhance a good ventilation. A place in a lonely cabin, away from civilization, is preferable to a bed in a hospital. Food must be nutritious and easily digestible; fats, blue-fish, salt fish, black and smoked meats,—all these should be avoided. The clothing must, above all things, be clean and adapted to the exigencies of the climate and of the season of the year. The skin of the patient must be kept clean by means of frequent bathing; in fact, leprous patients should take a daily bath. Isolation is an important factor, and a dormitory should never be occupied by more than one patient, and never by a healthy individual. Airing the sleeping-room is a great desideratum, and, whenever possible, it should be kept open day and night. Exercise in the open air should, as much as possible, be practised by the patient.

For a general medication the arsenical preparations have been recommended, as have also ichthyol, oleum gynocardiae, phenic acid, creasote, essence of eucalyptus, etc. All these medicaments are said to have produced beneficial results, but these results have not been constant. I myself have obtained variable ones from the use of the arseniate of sodium. In the case of the Sister of Charity to which I shall presently refer, the remedy seems to have effected a permanent cure; but the same drug has signally failed in other instances: the symptoms that had disappeared under its action would return after a few days. Was this due to the natural evolution of the disease, or did the medicament actually control the progress of the pathological phenomena? I do not desire to labor under an illusion, but I really think that the remedy did produce the amelioration observed, this being more marked in those patients that were constant in the use of the drug. Those who abandoned the remedy after a few days, and would not follow the hygienic measures prescribed, never exhibited favorable changes, notwithstanding the continued employment of internal and external stimulating antiseptic medication.

Without mentioning the remedies employed in the treatment of the cutaneous lesions, I will say that I have been able to remove the tubercles of the throat by means of the galvano-cautery and the application of Mackenzie's paste. The ulcers have improved under the action of a solution of resorcin of the strength of one per cent. and iodoform dissolved in ether, both medicaments being applied locally. Touching the diseased mucous membrane with a ten-per-cent. solution of chloride of zinc has also been beneficial in my hands. Interstitial injections of a solution of lactic acid into the tubercles only produced inflammation and suppuration, and therefore the remedy was soon abandoned.

As the patients that have come under my observation have never suffered any trouble of deglutition or respiration, nothing has been done in this respect. Should such difficulties occur it would be necessary to feed patients by means of the œsophageal tube on the one hand, and on the other, especially if stenosis should threaten life, to perform tracheotomy. A certain author has advised intubation in the latter instance; but, in my opinion, this method is applicable only (and I prefer it here) to acute cases.

I have also tried injections of Koch's tuberculine in this disease, and I have given it in as high doses as eleven centigrammes. The general reaction produced by the drug, however, has been moderate. I have not noticed a cumulative action of the remedy as observed by Kalindero and Babés. The local reaction has been quite marked, even from the first injections, and cicatrization of the leprous lesions has followed the administration of the tuberculine.

One of the leprous patients treated by Kalindero and Babés suffered from an extreme hoarseness of the voice, but the local reaction produced by tuberculine was followed by the disappearance of the hoarseness. On

the whole, there is no doubt that the remedy of Koch exercises a beneficial influence in leprosy; but as yet nothing definite can be said about the utility of the remedy until a further and more extensive trial has been made of it.

The case of the Sister of Charity, represented by No. 2 in the tables of my private practice given below, and in which I am convinced I have produced a cure, may be detailed as follows. She came to me six years ago complaining of the disease from which she had already suffered for five years. I found gray, extensive, and irregular spots over the face and extremities; blisters, most of them filled with a transparent, yellow liquid, and some of them with a sanguinolent, serous exudation; these blisters, varying in size from a pea to a walnut, were more numerous over the external surface of the forearms, thighs, and legs; they lasted for a short time, opening after twenty-four hours, or at latest at the end of forty-eight hours. At points where the epidermis remained intact, broad scales, of a grayish or blackish color, could be seen; where the dermis was exposed, superficial, smooth, slightly secreting ulcers would form, but without any inflammatory areola. In many parts the mixture of blood, pus, and serous exudation gave rise to the formation of crusts. Over the parts covered with the eruption, sensibility was much diminished, and yet the patient complained of cramp-like pains which would come without any apparent cause, and were the source of intense suffering; these pains were felt over the face and trunk, and especially over the extremities. At times she would lose all tactile sensibility in the hands, experiencing a sensation as if they were shrivelled up. Her eyesight was not quite clear; she had lost completely the sense of smell; she could hear well, and her voice was nasal. The palpebral conjunctiva was pale and covered with varicose blood-vessels; the nasal mucous membrane pale and dry, that of the soft palate thin and whitish, except over the arches and pillars, where it exhibited a violet hue. The uvula was extremely pale, pointed in shape, and œdematous. The patient suffered frequently from attacks of fever of an intermittent type. Her family history was totally free from any leprous taint. Her mother had died from consumption.

When the patient first entered the religious order she was perfectly healthy, and it was not until five years after she had been suffering from the leprous malady that she entered the leprosy hospital. Although there was no history of any specific taint, I prescribed Gibert's syrup, which was soon afterwards suspended on account of the bad effects produced. I then ordered a solution of arseniate of sodium to be taken in progressive doses,—that is, from two milligrammes up to two centigrammes; this amount was then gradually decreased to the original dose, to be again increased as described. This method was observed without interruption for three years. Quinine was administered when required by the feverish condition. For a local treatment the powder of coal-tar was employed; the blisters were opened, always endeavoring to keep the epidermis intact. The

strictest hygienic measures were advised and observed. Every summer the patient would go to the sulphur and selenio-arsenical springs of Carratraca. During a month or a month and a half she would bathe in and drink the water of said springs.

The patient was under my care for three years, and during that time I had the satisfaction of observing the most happy changes produced in her condition. The skin became free from all lesions; the sensibility returned to normal, as did also tactile sense and olfaction; the voice, though not completely, recovered the natural sound; the palatine mucous membrane reacquired the normal rosy hue. The only vestiges left by the disease were a rough and scaly skin (pityriasic) over the arms and legs and an occasional momentary neuralgic pain felt in various portions of the body. When I again saw the patient about a month ago, at the San Lázaro Hospital,—that is, three years after I had discharged her,—she was still enjoying the best of health, and I then noticed that the cure had been a permanent one.

I must say that this lady has been regularly taking the same medicine and observing the same hygienic method that I prescribed when she first came under my care. Now, have this constancy in the medication and the strict observance of hygienic measures contributed to the production of the cure effected? I believe that such has been the case, for I have seen many patients who, under similar circumstances and subjected to the same treatment, have experienced a great amelioration, but in whom this amelioration was as short-lived as their perseverance in following out my orders.

TABLE OF PATIENTS TREATED IN PRIVATE PRACTICE.

No.	Age.	Sex.	Residence.	Family.	Occupation.	Kind of Food.	Contagion.	Duration of General Disease.	Duration of Throat Trouble.	Diagnosis.
1	33	Male.	El Viso (Seville).	Uncle with cutaneous disease.	Baker.	Good.	No.	12 years.	9 years.	Leprosy.
2	32	Female	Valencia.	Consumptive mother.	Sister of Charity.	Good.	Suspicion of clothing.	9 years.	Not known.	Leprosy.
3	26	Male.	Not stated.	Leprous mother.	Farmer.	Oil.	No.	1½ years.	9 months	Leprosy.
4	22	Female	Cuba.	Healthy.	Daughter of a farmer.	Good.	No.	10 years.	Not known.	Leprosy.
5	28	Male.	Alcalá de Guadaira (Seville).	Healthy.	Farmer.	Oil.	No.	6 years.	3½ years.	Leprosy.
6	59	Male.	Bollullos del Condado (Huelva).	Healthy.	Stock-dealer.	Good.	No.	2 years.	Not known.	Leprosy.
7	23	Male.	Not stated.	Healthy.	Medical student.	Good.	No.	2 years.	Not known.	Leprosy.
8	55	Female	La Rambla (Cordova).	Healthy.	Not stated.	Good.	No.	50 years.	40 years.	Leprosy.
9	25	Female	Cabra (Cordova).	Father and cousin consumptive; grand-mother had an eruption.	Not stated.	Good.	No.	8 years.	7½ years.	Leprosy.

TABLE OF PATIENTS TREATED AT THE POLYCLINIC OF SEVILLE.

No.	Age.	Sex.	Residence.	Family.	Occupation.	Kind of food.	Contagion.	Duration of General Disorder.	Duration of Throat Trouble.	Diagnosis.
1	24	Male.	Triana (Seville).	Healthy.	Baker.	Good.	Public bath. ¹	1 year.	2 months	Leprosy.
2	32	Male.	Seville.	Healthy.	Mariner.	Good.	No.	1 year.	Not known.	Leprosy.
3	11	Male.	Seville.	Leprous uncle.	Farmer.	Large quantities of oil.	No.	1 year.	Not known.	Leprosy.
4	28	Male.	Orense.	Healthy.	Laborer.	Good.	No.	1 year.	Not known.	Leprosy.
5	37	Male.	Benacaron (Seville).	Healthy.	Baker.	Good.	No.	1 year.	4 months	Leprosy.
6	22	Male.	Jaen.	Healthy.	Weaver.	Good.	No.	4 years.	2 years.	Leprosy.
7	72	Male.	Lora del Rio (Seville).	Healthy.	Porter.	Good.	No.	Did not remember.	7 months	Leprosy.
8	41	Male.	La Algaba (Seville).	Healthy.	Farmer.	Large quantities of oil.	No.	3 years.	2 years.	Leprosy.
9	20	Male.	Seville.	Healthy.	Coachman.	Good.	No.	8 months	Did not know.	Leprosy.
10	48	Male.	Fuentes de Cantos (Seville).	Healthy.	Miner.	Good.	No	1 year.	Did not know.	Leprosy.

¹ Stated that disease came on after having taken a bath together with other persons, but did not know whether these were suffering or not from any cutaneous affection.

NOTE.—In these tables no description is given of the different lesions, owing to the imperfect records made.

CHRONIC LARYNGITIS, SIMPLE AND TRAUMATIC.

BY E. L. SHURLY, M.D.,

Professor of Clinical Medicine and Laryngology in the Detroit College of Medicine;
Chief of the Medical Staff of Harper Hospital; Laryngologist to St.
Mary's Hospital, etc., Detroit, Michigan.

THIS disease, as its name implies, consists of a chronic inflammation of the mucous membrane of the larynx, including its glandular, vascular, and connective tissue.

The several varieties included in the subject have been variously named and classified, according to different authors. Among the best classifications, perhaps, is that of Isambert,¹ which is as follows:

Secondary to acute.

Primitive.

Glandular.

Hypertrophic.

As this classification, like some others, does not recognize atrophic, hemorrhagic, or traumatic laryngitis, it would seem better to adopt classifications like the following:

1. Upon a clinical basis:

Primary,

Secondary, or consecutive (M. Mackenzie),

Traumatic.

2. Upon a pathological basis:

Simple or hyperæmic,

Hyperplastic (including oedematous),

Hypertrophic, { Superior,
Inferior,
Trachoma,
Pachydermia,

Atrophic,

Hemorrhagic.

Any of these pathological conditions may be secondary, or consecutive, or traumatic. Indeed, many observers believe that all forms of chronic laryngitis are secondary.

¹ *Annales des Maladies de l'Oreille et du Larynx*, vol. i. p. 276.

Germain Sée,¹ Bosworth,² Jarvis,³ and others maintain that a chronic laryngeal catarrh is always associated with or preceded by disease of the nasal or naso-pharyngeal tissue. According to Bosworth, there is no such thing as pure primary chronic laryngitis. He believes that the disease always extends from the nasal or naso-pharyngeal region. John N. Mackenzie⁴ also says, in an exceedingly full and able article on the subject of the etiology of chronic catarrhal inflammations, that "as an isolated affection it is rarely met with." Capart,⁵ Cohen,⁶ Roe,⁷ and others, while not taking so radical a stand on this question, entertain the conviction that it is generally associated with disease of the nose or naso-pharynx. And so with the majority of authors. However, as the normal anatomico-physiological standard of the nasal and naso-pharyngeal mucous membrane is as yet undetermined upon scientific principles, I do not see how it is possible to argue this point to an exact conclusion.

So far as ordinary clinical observation goes, it must be admitted that we meet with many cases of simple chronic laryngeal catarrh which are entirely independent of disease of adjacent structures, just as we meet with isolated chronic disease of the tonsils which is in no way dependent for its occurrence or continuance upon conditions of the neighboring parts. This apparent discrepancy of opinion can be accounted for undoubtedly, as suggested by A. H. Smith,⁸ Robinson,⁹ Langmaid,¹⁰ Cohen,¹¹ and others, by the fact that a majority of the cases of localized chronic laryngitis are not met with by the specialist until advanced or complicated.

There are a great number of cases called chronic hyperæmia or congestion which properly should be considered as primary or idiopathic chronic laryngitis; although I am aware that many authors fail to regard such cases as independent forms of disease.

Such cases are often associated, it is true, with perverted conditions of the liver, stomach, intestines, kidneys, heart, skin, or other organs; while some are associated with certain functional activities, such as menstruation, especially in young females. But, aside from these, there are many cases, most frequently met with in persons who use the voice extraordinarily,—as singers, public speakers, and the like,—which are primarily manifestations of permanent hyperæmia without much, if any, structural change. These cases deserve more definite consideration than has been usually conceded to them by the majority of writers.

¹ Diseases of the Lungs, American edition, 1885, p. 19.

² Archives of Laryngology, vol. iii. p. 183; and Transactions of the American Laryngological Association, 1887, p. 157.

³ Archives of Laryngology, vol. iii. p. 148.

⁴ Transactions of the American Laryngological Association, 1885, p. 35.

⁵ Transactions of the First International Congress of Laryngology, p. 11.

⁶ Diseases of the Throat and Nasal Passages, 2d ed., p. 473.

⁷ Transactions of the American Laryngological Association, 1882, p. 132.

⁸ Ibid., 1885.

⁹ Ibid., 1889.

¹⁰ Ibid., 1882.

¹¹ Diseases of the Throat and Nasal Passages, 12th ed., p. 482.

Langmaid¹ in two papers read before the American Laryngological Association, and Seiler,² have called particular attention to an inflammatory state of the laryngeal mucous membrane in singers, a sort of hyperæmia, which they ascribe to faulty methods of using the voice.

ETIOLOGY.

Both primary and secondary chronic laryngitis are due to a great variety of causes operating either directly upon the larynx or indirectly through disease or functional disturbance of the economy elsewhere. The greater number of cases undoubtedly arise from previous acute inflammation or other disease of the part (Cohen,³ Lennox Browne,⁴ John N. Mackenzie,⁵ Morell Mackenzie⁶).

Age.—While no age is exempt, by far the greater number of cases occur between the ages of eighteen and fifty. In childhood the acute form of the disease is most frequently met with, especially in connection with croup, diphtheria, scarlet fever, measles, cerebro-spinal meningitis, etc., yet the chronic form is not uncommon either as a consequence of the acute affection or independent of it, as a sequence of these diseases.

Michael⁷ states that in nearly all the acute infectious diseases of children the larynx is involved.

Dr. M. Gross,⁸ from a large experience, promulgates the opinion that there are three forms of what he calls subacute laryngeal catarrh in children,—the mild, the medium, and the severe.

Boys at the age of puberty, owing to the physiological changes occurring then, are susceptible to chronic laryngeal catarrh (Cohen,⁹ Von Ziemssen,¹⁰ Mackenzie, Mulhall¹¹).

Bergeron, after describing the changes which take place in the anatomy of the larynx at puberty, says that, since at this time the organ is in a state of congestion, which produces hypernutrition, any pathological condition existing before puberty is apt to persist after it. When met with in old age it is usually due to the vascular and glandular changes incident to senility. It is often associated with chronic bronchial catarrh, and is then mistaken for laryngeal phthisis.

It is doubtful if there be any old man living in a Northern climate in

¹ Transactions of the American Laryngological Association, 1887, 1889, 1890.

² *Ibid.*, 1889, 1890.

³ Diseases of the Throat and Nose, 2d ed.

⁴ Diseases of the Throat, 2d ed., p. 270.

⁵ Transactions of the American Laryngological Association, 1885, p. 45.

⁶ Diseases of the Throat and Nose, 1880, p. 272.

⁷ Archives of Laryngology, vol. i. p. 91.

⁸ Medicinische Monatsschrift. 1890.

⁹ Diseases of the Throat and Nose, 2d ed.

¹⁰ Cyclopædia of the Practice of Medicine, vol. iv. p. 213.

¹¹ Transactions of the American Laryngological Association, 1888, p. 139.

whom a chronic laryngeal catarrh may not be found by a hypercritical or officious practitioner.

Sex.—Males have heretofore been considered more liable than females. This has been accounted for by the nature of the habits and occupations of the former. However, "modern times" have opened up so many hitherto masculine avenues of occupation for women, and furnished so many overheated and badly-ventilated offices, stores, and houses, that we meet with a proportional increase of the number of cases in females.

The atrophic form is said to be more often found in females than in males.

Occupation.—For many years clergymen and other public speakers, singers, actors, street-criers, and sailors, and such as use the voice extraordinarily, have been considered especially liable to this disease. The reason of this is obvious, even setting aside surrounding circumstances, for any organ of the body upon or about which undue functional energy is demanded will be prone to suffer to a greater or lesser degree, especially when so used under particular circumstances, for it is but a step from a physiological to a pathological state of vascularity.

The forms most frequently met with in these persons are the hyperæmic and the hyperplastic. However, any of the other forms (hypertrophic, atrophic, or hemorrhagic) may be met with.

Artisans who work in dust or smoke, such as blacksmiths, stone-cutters, broom-makers, employees in knitting-factories, furriers, and saloon-keepers, who are constantly subjected to the inhalation of air vitiated with human emanations and tobacco-smoke (Cohen,¹ Lennox Browne²), brewers, butchers, and ice-men, who are frequently subjected to violent changes of temperature while going in and out of ice-boxes or cold vaults, teamsters and street-car conductors, who are exposed to inclemencies of weather and also to street-dust, are especially liable. Regarding street-dust, Dr. John N. Mackenzie,³ in his paper already referred to, thinks that there is too much stress laid upon street-dust as an etiological factor, while Miguel and others believe street-dust to be an important cause.

Recently Luigi Manfredi,⁴ who examined the street-dust of Naples, found that the number of microbes of all sorts to the gramme amounted on the average to 761,521,000. Remarkable differences were disclosed in the proportion of microbes to dust in different quarters of the city, varying from 10,000,000 to 5,000,000,000 per gramme. Many species of these he found by experiment to be pathogenic.

While but little importance is to be placed upon the special agency of the microbes, it is obvious that the inhalation of an undue quantity of dust, more than can be strained out by the nasal passages, must exert a baneful

¹ Diseases of the Throat and Nose, 2d ed.

² Diseases of the Throat, 2d ed., p. 253.

³ Transactions of the American Laryngological Association, 1885, p. 37.

⁴ British Medical Journal, 1891, p. 960.

irritating influence upon the mucous membrane of the larynx, where much of it will be deposited ; neither is it necessary from this point of view that nasal or naso-pharyngeal disease should pre-exist.

Book-keepers who use the voice considerably (calling off) in overheated offices and who perhaps sleep in cold rooms often suffer from chronic laryngitis.

Habits.—The habits and mode of life certainly have much to do with the production and continuance of this affection.

Eating.—Bad habits of eating or drinking, such as taking large quantities of cold drink in close alternation with hot liquids or food, will often exert a deleterious effect upon the larynx independently of any pharyngeal complication (Cohen).¹

Alcohol.—The abuse of alcoholic liquors is a prolific source of chronic laryngeal catarrh. In fact, there are few “immoderate drinkers” who do not suffer more or less with the disease. The pachydermic form is said to be confined to “drinkers.” Many laryngologists—among them Delavan, Langmaid,² and Schroetter³—will not attempt treatment of patients addicted to this habit until indulgence is stopped.

Tobacco.—The habit of smoking tobacco probably takes the lead as an exciting cause. There are, indeed, very few persons who are addicted to any great degree to this habit who do not show with the laryngoscope more or less hyperæmia or inflammation of the laryngeal mucous membrane.

Dr. M. F. Coomes⁴ believes that the baneful effects of the use of tobacco in the production of chronic catarrhal affections of the throat have not been overestimated. He thinks chewing and snuff-dipping quite as deleterious as smoking, and that the habit of chewing is especially pernicious in those who have to use the voice much.

Dr. Stockton,⁵ of Chicago, in the discussion following the reading of a paper by Dr. Coomes at the Ninth International Medical Congress, stated that in his experience the habit of chewing was more deleterious than that of smoking. Dr. Isaac Barton⁶ and others are inclined to rank cigarette-smoking as being the most hurtful to the larynx of all the tobacco-habits.

Diseases and General Conditions.—Frequent attacks of acute laryngitis (“colds”) in persons who use the voice much invariably lead to the chronic form of the disease. Hence public singers and actors, being especially liable to attacks of acute laryngitis on account of their unavoidable exposure in cold theatres, travelling, and other vicissitudes attending their profession, and also being under the necessity often of using the voice during

¹ Cohen, *Diseases of the Throat and Nose*, 2d ed.

² *Transactions of the American Laryngological Association*, 1889.

³ *Krankheiten des Kehlkopfes*, 1889.

⁴ *Transactions of the Ninth International Congress*, vol. iv. p. 102.

⁵ *Ibid.*, p. 103.

⁶ *Annual of the Universal Medical Sciences*, 1889.

the course of such acute attacks, are frequently the subjects of chronic laryngitis.

Naso-Pharyngeal and Nasal Diseases.—We have already spoken of the pronounced opinions held regarding these diseases as factors in the etiology of chronic laryngeal catarrh. Whether nasal disease ever leads to such structural changes as characterize the hypertrophic, atrophic, and pachydermatous forms is a question; but that they may be associated is of course a fact. Many observers believe that the atrophic form is but an extension of pharyngitis sicca.

That enlargement of the pharyngeal tonsil or other disease of the adenoid tissue at the pharyngeal vault, by causing mouth-breathing, will in time bring about a catarrhal inflammation of the larynx as well as of the pharynx, is well supported by ample experience.

Heredity.—A few observers recognize a catarrhal diathesis (Beverley Robinson,¹ Boucheron,² Cohen³); while many, among them Mackenzie⁴ and B. Fraenkel, do not think such a particular tendency exists, or that there is sufficient evidence of a so-called catarrhal diathesis.

Although it would be extremely difficult to describe with exactness a catarrhal diathesis, yet it is a matter of almost common observation that members of certain families are unusually susceptible to diseases of the mucous membranes independently of prevailing exciting causes. I am familiar with families in which this proved a marked weakness. In one of these (consisting of five), whose members were noted for their good voices and who were otherwise healthy, not one was able to continue the cultivation of the voice up to an artistic point, on account of the supervention of chronic laryngeal catarrh, notwithstanding all other circumstances were favorable.

I am sure that due consideration of many such facts would lead one to the conclusion that there is a predisposition in certain individuals to diseases of the mucous membranes which cannot be explained upon any other hypothesis than that of hereditary proclivity. Such individuals are often classed with those inheriting a so-called strumous or tuberculous tendency, but unjustly, it seems to me, inasmuch as they are not peculiarly liable to tubercular affection. Only a few years ago some observers—Ziemssen,⁵ Cohen,⁶ and others—looked upon long-continued chronic laryngeal catarrh, especially if the sputum contained much pus, as a sort of primary tuberculous stage.

In this connection we would refer to the statements made by several writers that chronic laryngeal catarrh sometimes occurs from the irritation

¹ *Annales des Maladies de l'Oreille et du Larynx*, vol. i. p. 367.

² *Annual of the Universal Medical Sciences*, 1890.

³ *Diseases of the Throat and Nose*, 2d ed.

⁴ *Transactions of the American Laryngological Association*, 1885.

⁵ *Cyclopædia of the Practice of Medicine*, vol. iv. p. 215.

⁶ Cohen, *Diseases of the Throat*, 2d ed.

or infection resulting from the presence in the larynx of more or less secretion which has "dropped down" from the naso-pharynx.¹ The explanation given is about as follows: the vestibule of the larynx being generally open, and the lower pharynx and œsophagus closed, any redundancy of secretion above would naturally flow gently down into the open laryngeal vestibule and accumulate there for a time, until ejected by cough, this action taking place during sleep especially.

However plausible this theory may appear at first sight, it seems fallacious when we consider that the larynx is not so constructed as to receive and hold much mucus, not of its own production, without very decided interference with quiet respiration, and, furthermore, that it is well known by physiologists that the œsophagus automatically opens, if necessary, even during sleep, if the accumulation be sufficient to make such a movement necessary.

Enlarged glands at the base of the tongue are sometimes the cause of chronic laryngeal catarrh (Cohen²), but not so often as has been imagined. By paying particular attention to this locality in all laryngeal examinations, one will be astonished at the number of individuals who have apparently enlarged glands at the base of the tongue without showing any signs of laryngeal catarrh. One will therefore soon become convinced that the pathological import of such formation has been exaggerated. Great care must be exercised also not to overlook a low-lying tonsillar lobe (Allen³), which may or may not constitute an etiological factor.

Chronic tonsillar disease (hypertrophic—follicular) is sometimes a cause of this affection. The mechanical irritation of an elongated uvula has been enumerated as one of the causes of chronic laryngitis by Beverley Robinson,⁴ Gottstein,⁵ and others. While this may be true of isolated cases, the absence of such a condition in many cases of laryngeal disease would seem to lessen its importance as a causal factor.

Impaired cardiac power (Beverley Robinson⁶) will sometimes induce a chronic or passive congestion of the larynx, especially in a subject who has been using the voice much.

Dyspepsia and indigestion are frequent precursors of chronic laryngeal catarrh, also intestinal irritation and hemorrhoids, especially in tobacco-smokers and nervous persons; the disease under such conditions probably originating through the nervous mechanism belonging to the pneumogastric nerves. It is a fact well known to laryngologists that few people who suffer for any length of time from gastric derangement fail to exhibit in the laryngoscopic mirror a certain degree, at least, of hyperæmia of the

¹ Beverley Robinson, Transactions of the American Laryngological Association, 1889.

² Diseases of the Throat and Nose, 2d ed.

³ Transactions of the American Laryngological Association, 1891.

⁴ Ibid.

⁵ Die Krankheiten des Kehlkopfes, 1890.

⁶ Transactions of the American Laryngological Association, 1889.

laryngeal mucous membrane. These facts were brought out in an interesting manner in a discussion which took place on the paper of Dr. Beverley Robinson¹ read before the American Laryngological Association in 1885.

Acute desquamative nephritis frequently gives rise to chronic laryngitis, either simple or, oftener, œdematous, the swelling being a veritable hyperplasia and remaining for a considerable time, and not a simple œdema, such as we often observe in the course of chronic Bright's disease.

Ovarian and uterine disease frequently cause chronic laryngeal catarrh, usually of the simple variety, first producing congestion and spasm, then hyperplasia, and sometimes hypertrophy, as in the case of a woman with ovarian disease who came under my observation recently at Harper Hospital, Detroit, who had marked subglottic hypertrophy, suffering with so much respiratory obstruction as to cause serious paroxysms of dyspnoea, requiring oxygen inhalations on several occasions, and finally leading to preparations for the performance of tracheotomy. She slowly improved, however, under iodine and iodide of potassium up to a certain point, when the ovaries and tubes were removed by Dr. J. H. Carstens, with the result of producing rapid and effectual relief. A few days after the operation her voice returned and the dyspnoea became almost unnoticeable. Just before leaving the hospital laryngoscopic examination showed the hypertrophy to have greatly subsided, while her voice was good, although hoarse, and respiration tolerably easy.

Reflex action and structural nervous diseases affecting other parts of the throat or body generally are frequent etiological factors. Without doubt the intimate relationship between the pharynx and the larynx is due to nervous influence rather than to continuity of structure, as illustrated by the effect of a drink of water in allaying laryngeal irritation during the exercise of the voice (Cohen²): the water, of course, does not enter the larynx; likewise the influence of distant or neighboring pathological conditions may be carried to the larynx.

Chronic congestion leading to structural change may be produced by improper use of the voice, as already mentioned (Seiler³ and Langmaid⁴). Likewise excessive use of the voice, instead of directly inducing local disease, may lead to uterine disease first, according to Wing,⁵ thus demonstrating the truth of the oft-repeated observation that reflex action may play the most important part in pathological processes, especially when the ganglionic nervous system is concerned.

Frequent glottic spasm from lumbricoid worms, leading afterwards to chronic laryngeal catarrh, has been reported by M. Maselli.⁶ Abnormally

¹ Transactions of the American Laryngological Association, 1885.

² Diseases of the Throat and Nose, 2d ed.

³ Archives of Laryngology, vol. iii. p. 182.

⁴ Ibid., vol. iv. p. 170.

⁵ Ibid., vol. ii. p. 101.

⁶ Ibid., vol. iii. p. 88.

continuous tension of the vocal cords (Hooper¹), or extreme debility from excessive use of the voice (Langmaid²), may also directly lead to chronic laryngeal catarrh. Often structural nervous diseases, such as bulbo-nuclear disease and affections of the cortex, produce this affection (John N. Mackenzie,³ Krause,⁴ Delavan,⁵ J. Garel⁶).

Although a cortical centre for the larynx is still a matter of discussion, yet brain-disease frequently leads to laryngitis. Neurasthenia and vaso-motor disturbances (Daly⁷), ataxia (Scherschewsky⁸), and other diseases of the spinal cord, may be direct causes. Direct as well as indirect irritation of the recurrent nerves (Livon,⁹ Hooper¹⁰), as in a case of pressure by lymphatic glands cited by Gouguenheim,¹¹ will produce it. Diseases of the ear of a chronic nature may produce the disease reflexly.

Many other nervous disorders (hysteria and chorea) give rise to it; so also perverted mental function, such as melancholia, or even severe grief (Isambert¹²). Hemiplegia and such affections often favor its occurrence, by allowing the entrance of mucus, salivary secretion, and particles of food, which the larynx, from deficient excito-motor sensibility, fails readily to eject.

Erysipelas frequently causes this affection, by inducing an acute œdema which is only partially removed by absorption, thus leaving the sub-mucous tissues swollen, constituting a chronic œdematous variety (Delavan,¹³ Ferd. Massei¹⁴). The exanthemata—scarlet fever, measles, etc.—are prolific causes, not only in children, as before mentioned, but also in adults (Moore,¹⁵ Daly,¹⁶ Milsonneau,¹⁷ and B. Barth¹⁸). Non-infectious cutaneous diseases may also give rise to it: instances are recorded of chronic laryngeal catarrh following pemphigus,¹⁹ urticaria²⁰ (Mackenzie,

¹ Transactions of the American Laryngological Association, 1887.

² Archives of Laryngology, vol. iv. p. 170.

³ Transactions of the American Laryngological Association, 1887.

⁴ Annales des Maladies de l'Oreille et du Larynx, vol. xii. pp. 218–221.

⁵ Transactions of the American Laryngological Association, 1890.

⁶ Archives of Laryngology, vol. ii. p. 101.

⁷ Transactions of the American Laryngological Association, 1889.

⁸ St. Petersburg Medicinische Wochenschrift, and Archives of Laryngology, vol. iii. p. 88.

⁹ Archives de Physiologie Normale et Pathologique, vol. ii. p. 587.

¹⁰ Bowditch and Bosworth, Transactions of the American Laryngological Association, 1883.

¹¹ Annales des Maladies de l'Oreille et du Larynx, vol. x. p. 16.

¹² Ibid., vol. i. p. 276.

¹³ Transactions of the American Laryngological Association, 1889.

¹⁴ Rivista Clinica e Terapeutica, vol. vii., No. 1.

¹⁵ London Lancet, May 19, 1883.

¹⁶ Transactions of the American Laryngological Association, 1889.

¹⁷ Annales des Maladies de l'Oreille et du Larynx, vol. xii. p. 146.

¹⁸ Ibid.

¹⁹ Archives of Laryngology, vol. iii. p. 88.

²⁰ Transactions of the American Laryngological Association, 1885.

Isambert¹), and herpes (B. Fischer,² Schnitzler,³ S. H. Chapman,⁴ G. Herzog⁵).

Rheumatism⁶ and lithæmia⁷ also cause it, especially the former disease when affecting the arytenoid joints or the laryngeal muscles. Chomel pointed out this relationship years ago. It will be found in practice, however, that persons who are subject to muscular rheumatism or so-called neuralgia or rheumatic phlegmonous sore throat (A. Mantle,⁸ Isambert⁹) are often afflicted with a chronic laryngitis. Laranza¹⁰ has not been able to find a single case affecting the laryngeal muscles, however. The disease is exceedingly infrequent in subjects of acute articular rheumatism, although Ingals, in a very able paper read before the Ninth International Medical Congress, cites three recorded examples of an acute form in connection with articular rheumatism, and Elsberg¹¹ a case affecting the crico-arytenoid joint. Ingals further says that he can find no mention in medical literature of a chronic rheumatic laryngitis, but clearly establishes the characteristics of such an affection. Fauvel and Moure have demonstrated in their clinics a number of rheumatic manifestations in chronic laryngeal catarrh, which they seem to regard, however, as of rather secondary importance. Vierordt¹² cites a case in which there was a combination of goitre and chronic hypertrophic laryngeal catarrh, the latter affection getting better as the goitre grew worse.

Small-pox and typhoid fever are very apt to leave the patient with a chronic laryngeal catarrh with or following a perichondritis and laryngeal stenosis. Schiffers¹³ and Dr. Paul Koch¹⁴ give examples of these disastrous results in connection with chronic laryngitis. C. Gerhardt¹⁵ reports a case of typhoid fever with striking laryngeal inflammation and ulceration, which he denominates "laryngo-typhoid." He believes such cases occur oftener than is supposed, and that they are overlooked.

Phlegmonous or suppurative inflammation of the larynx very generally leads to a chronic inflammation of longer or shorter duration.¹⁶ Moure¹⁷

¹ *Annales des Maladies de l'Oreille et du Larynx*, vol. i. p. 193.

² *Berliner Klinische Wochenschrift*, No. 50.

³ *Archives of Laryngology*, vol. i. p. 88.

⁴ *Transactions of the American Laryngological Association*, 1884.

⁵ *New York Medical Record*, July 16, 1881.

⁶ *Transactions of the American Laryngological Association*, 1889.

⁷ *Ibid.*, 1888.

⁸ *British Medical Journal*, November, 1885.

⁹ *Annales des Maladies de l'Oreille et du Larynx*, vol. i. p. 192.

¹⁰ *Annual of the Universal Medical Sciences*, 1889, G. 3.

¹¹ *Archives of Laryngology*, vol. iii. p. 349.

¹² *Journal of Laryngology and Rhinology*, vol. ii., No. 7, p. 253.

¹³ *Annales des Maladies de l'Oreille et du Larynx*, vol. xi. p. 247.

¹⁴ *Ibid.*, vol. x. p. 358.

¹⁵ *Archives of Laryngology*, vol. ii. p. 121.

¹⁶ O. Chiari, *Annual of the Universal Medical Sciences*, 1891, p. 1; P. Merklen, *ibid.*, 1891, p. 3; E. Germonig, *ibid.*, 1889, G. 2, vol. iv.

¹⁷ *Annual of the Universal Medical Sciences*, 1890.

finds in cases of this nature great similarity to phthisis. In a case of primary phlegmonous inflammation of the right ventricular band reported by the author in 1879¹ there followed for a long time a general laryngeal catarrh.

SYMPTOMATOLOGY.

Subjective.—The early symptoms of primary chronic laryngitis are usually not well marked, because of the insidious approach of the disease. A sense of fulness, stiffness, and itching, referred to the larynx and accompanied by acts of hemming and hawking, constitute the principal early signs. If the person be a public speaker, singer, or in any other way accustomed to extra vocal activity, these symptoms will be more marked and progressive and there will be soon added more or less hoarseness, especially after vocal effort. These uncomfortable sensations increase in duration and frequency, until efforts at clearing the throat become necessary during prolonged conversation, with the supervention of slight cough as well as hawking. The voice becomes hoarser and less reliable for prolonged or extra effort, and after a while is “clear” only in the early morning or after a period of rest, while a “hacking cough” is more or less a permanent feature, although the quality of the cough may have undergone permanent change. A good voice for conversation may be retained.

Some singers in a moderately advanced state of the disease show no hoarseness during conversation, but only at the beginning of singing; while others are hoarse during conversation and not at all after “getting started” at singing (Langmaid²). This observation applies also to some actors. Hoarseness is an exceedingly variable symptom, and, strange to say, does not always represent the extent or gravity of the pathological condition: for instance, a very general involvement and thickening of the laryngeal mucous membrane in one case will give but moderate hoarseness, while a lesser degree of structural change in another will almost if not quite annihilate the voice.

This discrepancy has been accounted for in various ways by several writers. It has been attributed to dryness for want of lubrication of the surface of the vocal cords, by Sajous,³ to interfibrillar thickening in the vocal muscles, by Cohen⁴ and Lennox Browne,⁵ to peripheral nerve-pressure, by Livon,⁶ Moure, and others, and to mechanical interference from hyperplasia, by Pipping⁷ and Brissard.⁸ Undoubtedly all these explana-

¹ Archives of Laryngology, vol. i. p. 64.

² Ibid., vol. iv. p. 170.

³ Diseases of Nose and Throat 1886, p. 338.

⁴ Diseases of the Throat and Nose, 2d éd., p. 484.

⁵ Diseases of the Throat, 2d éd., p. 273.

⁶ Archives de Physiologie Normale et Pathologique, 1890.

⁷ Zeitschrift für Biologie, Leipsic, 1890, No. 1, p. 80.

⁸ Archives de Laryngologie et de Rhinologie, 1890, No. 3, p. 16.

tions are in the main correct, but apply to particular cases, so that no general explanation will meet all cases. The character of the individual, and the extent, nature, and part in particular involved, will determine the amount of functional disturbance: for instance, a little thickening at the inter-arytenoid incisure will prevent approximation of the vocal cords and result in great vocal disability, while the further course of the disease will be marked by greater hoarseness and decided difficulty in voice-production, requiring often greater expiratory effort; there will be also marked increase of cough.

In advanced stages aphonia may be complete, or there may be a brassy whisper broken by discordant raspy sounds. In this instance there is much complaint of fatigue referred to the chest and epigastrium, and sometimes to the muscles of the back,—due undoubtedly to the extra tax imposed upon the respiratory muscles by forced expiration. The patient also complains of pain in the larynx during such efforts, and shows clearly a disposition to avoid speaking. There is usually little or no odynphagia, except in some of the secondary or traumatic forms of the disease. Respiration is not very much embarrassed unless there be considerable thickening of the mucous membrane or lack of movement of the vocal cords, except in the œdematous or hypertrophic varieties. In these forms the obstruction to respiration is sometimes very great, although not so alarming as in acute œdematous laryngitis, because of the slower approach of the conditions. In a case of chronic œdematous laryngitis following small-pox affecting principally the epiglottis which I saw some years ago, the patient experienced no suffocative attacks if he held the tongue forward out of the mouth. There is also considerable pain, sometimes of a lancinating character, referred to the larynx, the trachea, and the region of the neck, which may be paroxysmal like neuralgia. This is especially noticed in the hypertrophic form.

In the œdematous variety there is generally more or less difficulty of swallowing, especially of liquids, owing to the imperfect closure of the epiglottis; also considerable dyspnoea, especially on exertion. The expectoration is at first a little glairy mucus, changing later on to a muco-pus and increasing in quantity to perhaps two ounces or more daily. The cough is sometimes very harassing.

In the atrophic form the principal complaint is of a dry burning or pricking sensation, especially after general exercise or having walked some distance facing the wind, and a constant tickling or desire to cough. There are also in many cases suffocative attacks, coming on mostly during the night or early morning, simulating spasmodic croup or asthma.

The cough is usually of a whistling character, and occasionally spasmodic, similar to whooping-cough. I saw a case in consultation in an adult which was supposed from the character of the cough to be an unusually prolonged case of whooping-cough, but laryngoscopic examination revealed at once the nature of the difficulty, atrophic laryngitis. There is very little

or no expectoration: indeed, when the patient can expectorate a little secretion there is a sense of relief.

The hemorrhagic form is characterized by the expectoration of blood and bloody mucus. The patient can very often predict from his sensations the onset of a new or extra hemorrhage. While there is seldom complaint of pain, there is always complaint of fulness and stuffiness of the larynx, with a sense of something foreign in the organ.

Pachydermia laryngis, first described by Virchow, manifests few particular subjective signs, except the persistence of dyspnoea, due to impaired abduction of the vocal bands, and a continual, regular hoarseness, with sometimes odynphagia. The evenness of the hoarseness is quite remarkable. There are no general symptoms especially belonging to this condition, except such as go with the clinical history of alcoholism, to which it is often related. The constitutional disturbance depends largely upon the amount of dyspnoea present, which is sometimes alarming. Chiari¹ and others believe the affection to be a result of syphilitic infection, but Virchow,² Meyer,³ and Bergengrün⁴ consider it to be due to the irritation from chronic catarrhal inflammation of the mucous membrane, and, like trachoma, partly the result of friction between the opposite nodular edges of the vocal bands. There have been several cases reported since Virchow's publication on the subject, the observations on which seem to agree in the main.

LARYNGOSCOPIC APPEARANCES.

Hyperæmia.—This may be general throughout the whole mucous lining of the larynx, or may be confined to the vestibule, the epiglottis, the arytenoid region, the ary-epiglottic folds, or the vocal or ventricular bands.

When hyperæmia is partial it is commonly seen in the order of frequency specified above, with the exception perhaps that in vocal artists the vocal cords, especially their posterior half or free edges, may be the only part displaying abnormal color. The color, although heightened, varies very much in different cases, from a deep red to a pinkish or brownish red; while the parts normally appearing white or gray in the laryngeal image (such as the vocal bands) may be pink or pinkish-red in streaks, or of a mottled brown or a slaty-gray color.

Although hyperæmia is due to increased vascularity, enlarged blood-vessels are seldom seen, except over the epiglottis, and perhaps two or three traversing the upper laryngeal surface of the vocal bands.

There is very little extra secretion visible. The surface is usually smooth, and the image may convey an idea either of general moisture or of dryness.

¹ Annual of the Universal Medical Sciences, vol. iv. p. 5.

² Ibid.

³ Ibid.

⁴ Berliner Medicinische Wochenschrift, July, 1889.

In the majority of cases swelling or thickening of the mucous membrane is not apparent (Elsberg,¹ Hooper,² Langmaid,³ Jarvis,⁴ Gottstein⁵).

Laryngeal examination from day to day shows great variation of color independently of treatment, especially in nervous individuals and in persons who use the voice much.

The laryngoscopic appearance in chronic hyperæmia may be unaccompanied by corresponding subjective symptoms. Indeed, many actors showing this condition are not debarred from the exercise of their voice upon the stage. In other persons, also, we are often astonished to see a notable chronic hyperæmia without much, if any, hoarseness or other uncomfortable symptoms.

Hyperplastic Form.—In this variety the laryngoscope reveals not only hyperæmia, but also a structural change of the mucous membrane more or less general according to the extent of the disease, and varying from a slight thickening to a sodden, swollen state simulating œdema.

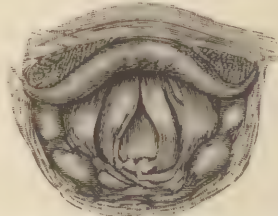
These changes may be quite general or confined to any one or more of the regions of the laryngeal cavity. The simpler degree is usually limited to the epiglottis, arytenoid region, and ary-epiglottic folds, but may appear saliently in one or both vocal or ventricular bands (Fig. 1). Unlike

FIG. 1.



Chronic laryngeal catarrh, showing a nodule on the right vocal band from extraordinary hyperplasia at that point (Burow).

FIG. 2.



Chronic inflammation of the vocal bands, with subglottic swelling (Türk).

simple hyperæmia, the blood-vessels are prominent especially over the epiglottis and vocal bands, while in some cases the veins show distinctly, constituting the phlebeetasis laryngea of Mackenzie.

The severer degree shows more marked textural change than mere thickening, for the surface may appear granular (chronic laryngitis granulosa), or the posterior wall of the larynx only may be prominent and uneven, as if the exudate had been deposited and organized in layers one upon the other, or as broad projecting papillæ⁶ (Fig. 2).

The vocal bands may appear round or very broad, with roughened

¹ American Journal of the Medical Sciences, October, 1881, pp. 330-336.

² Transactions of the American Laryngological Association, 1887.

³ Ibid., 1887.

⁴ Ibid., 1881.

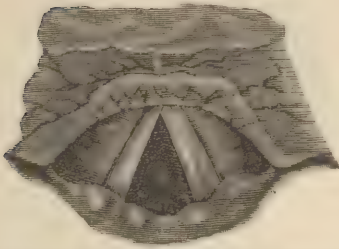
⁵ Krankheit des Kehlkopfes, 1890, p. 109.

⁶ Killian, Untersuchungen über den Larynxwand, 1891.

surface, while the edges seem loose or longitudinally creased, as if folded up, or show thinnish prolongations, as if fringed on their under surface (Fig. 3).

The ventricular bands, one or both, may be so swollen as almost to

FIG. 3.



Chronic laryngeal catarrh, showing particular swelling and injection of the left vocal band (Burow).

FIG. 4.



Chronic laryngeal catarrh, showing swelling of ventricular bands (Burow).

obscure the vocal bands, appearing sodden, of dark red color, and almost if not quite obliterating the appearance of a ventricular space (Fig. 4). One or both arytenoid projections may show marked enlargement, with a granular surface.

There is always excessive secretion apparent, either thin or thick in consistence, sometimes enough to form bridges or threads hanging between the vocal or ventricular bands, or as small clumps plastered to the roughened posterior wall, or stringy masses depending between the arytenoids, or hanging to the ventricular bands, or profusely bathing the arytenoids (Fig. 5).

Often there is also a collection to be seen below the glottis sticking to the tracheal wall. The inter-arytenoid space seems to be a favorite loca-

FIG. 5.



Chronic laryngeal catarrh, showing secretion adhering to the vocal bands and at inter-arytenoid space (Burow).

FIG. 6.



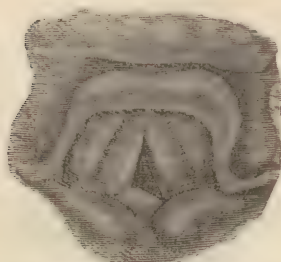
Chronic laryngeal catarrh, with aphonía from interstitial deposit (Burow).

tion for the collection of the secretion, for it will be seen in this situation oftener than elsewhere. The mobility of the arytenoids is greatly lessened, and sometimes almost obliterated, simulating paralysis (Fig. 6).

Œdematous Form.—The picture of the so-called chronic œdematous

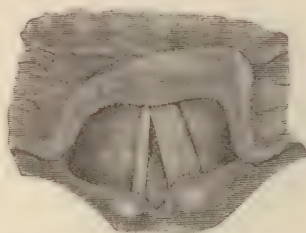
laryngeal catarrh differs considerably from the foregoing, in that the swelling is more pronounced and of a dark-yellowish or grayish color, marked by enlarged blood-vessels upon the surface; sometimes these are so nu-

FIG. 7.



Edematous laryngitis, showing the whole mucous membrane swollen, and particularly the arytenoids and posterior wall of the larynx (Burow).

FIG. 8.



Edematous laryngitis, showing a more chronic and partial involvement (Burow).

merous and prominent as to give a pinkish or reddish hue to the swelling (Fig. 7).

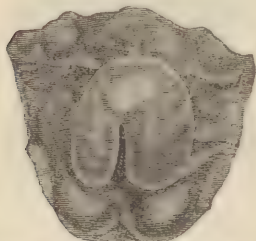
The epiglottis, arytenoids, and ary-epiglottic folds are more often affected; although in many instances either the epiglottis or one or other of the arytenoids or ary-epiglottic folds is alone involved in the swelling (Fig. 8).

The swelling differs from acute oedema by showing greater firmness to the touch, less prominence, darker color, and less glistening and more vascularity of the surface.

When the swelling is considerable it is almost impossible to get a view of the underlying region, such as the ventricular or vocal bands, especially in cases where the mobility of the arytenoids is almost entirely lost (Fig. 9).

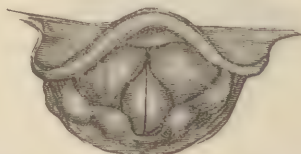
Hypertrophic Form.—There are two principal forms of hypertrophic laryngitis,—viz., superior (Fig. 10) or general, and inferior (Fig. 14),

FIG. 9.



Edematous laryngitis, showing swelling mostly confined to the epiglottis (Burow).

FIG. 10.



Oedema and hypertrophy of the ventricular bands after typhus fever (Türek).

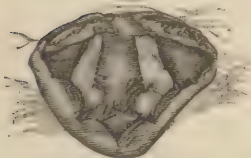
besides the nodular proliferations called trachoma and pachydermia, which are really localized hypertrophies.

The former presents a laryngoscopic image similar to that of chronic oedema (Fig. 10), except that the surface is not very vascular, is very

uneven, presenting ridges, projections, furrows, or prominences differing in color one from the other, at the same time entirely effacing the natural contour and appearance of the parts; or they may be circumscribed, somewhat simulating tumors.

It is generally limited in extent, although occasionally it may involve pretty nearly the whole laryngeal lining; sometimes only one of the ventricular bands or ary-epiglottic folds or the inter-arytenoid region is the seat of the change. When secondary, however, to some other disease, as, for instance, perichondritis, as is often the case, it will be limited to the situation of the early lesion (Fig. 11). The "chorditis tuberosa" of Türck or "trachoma of the vocal cords" of Morell Mackenzie is an instance of localized hypertrophy confined to the mucous glands of the vocal cords. These appear as white spots projecting from along the middle portion of the ventricular bands, and are surrounded by patches of congestion. They usually appear in cases of chronic laryngitis of long standing in singers and public speakers.

Pachydermia Laryngis.—The laryngeal image shows a sort of non-vascular warty projection of dark gray or yellowish hue, rough or laminated, issuing from the posterior section of the upper or inner side of the vocal bands. The growths are usually bilateral and situated opposite each other when affecting both cords (Fig. 12). The laryngeal mucous membrane is generally hyperæmic and thickened, and sometimes there is subglottic hypertrophy. The vocal bands are of dark-red color throughout their extent, exceptionally dark gray with red lines running longitudinally.



Pachydermia laryngis (Bergengrün).

the posterior wall of the larynx (Figs. 13 and 14). The swelling is usually covered by inspissated secretion looking like scabs of greenish or grayish tint, not easily removed by acts of hawking or coughing. During a brisk inspiration the swelling is brought to view, and then it is seen to be a scroll-shaped growth beneath the vocal bands and continuous with their under surface.

Hemorrhagic Form.—The laryngeal appearance shows three principal local conditions,—vaso-motor turgescence, extravasation, and lesion of the surface.

FIG. 11.



Perichondritis laryngis affecting principally the left arytenoid cartilage (Burrow).

Chronic Laryngitis Hypertrophica Inferior.—

The laryngoscopic image is quite striking from the appearance of grayish rubber-like rolls just beneath the vocal cords and moving somewhat with them. Although seeming to be unattached, the swelling is most marked towards the posterior portion of the vocal bands, and apparently extends to

In the first, the whole laryngeal mucous membrane, including the vocal bands, is in a state of high vascular turgescence,¹ and blood issues

FIG. 13.



Chorditis vocalis hypertrophica inferior (Burow).

FIG. 14.



Chorditis vocalis hypertrophica inferior, showing great diminution in size of the vocal bands (Burow).

from numerous spots, giving the characteristic mottled appearance to the upper surface of the ventricular bands, epiglottis, or vocal bands² (Fig. 15). These darkish irregular spots mark the situation of small clots.

Sometimes, as in typhus fever and scorbutus, there seems to be a general transudation of a bloody serum from numerous papular red patches or areas in different parts of the larynx: this liquid does not coagulate easily, but freely bathes the membrane, collecting here and there in drops along the shelving projections of the vocal and ventricular bands.

In other instances the hemorrhage is quite localized, so that the blood may be seen oozing or trickling from its source of exit over the neighboring surface. Clinton Wagner³ reports a very interesting observation of this sort, where the blood could be seen oozing in little drops from the left ventricular band or ventricle.

When erosion or ulceration or rupture of a membrane has taken place,—which, of course, is not common,⁴—it will be indicated by the nature and quantity of the blood poured out, if the seat of lesion be out of direct view.

FIG. 15.



Laryngitis hæmorrhagica (Burow).

When the hemorrhage has taken place beneath the surface,—extravasation,—it will be indicated by dark blotches over which the surface will be slightly raised. This is not an infrequent occurrence in typhus and typhoid fevers, scorbutus, and other dyscrasiæ.

The extravasation is sometimes quite localized. A. H. Smith,⁵ C. E.

¹ Hartman, Transactions of the American Laryngological Association, 1879; and Dronault, Paris, 1891.

² Porter, Transactions of the American Laryngological Association, 1889, p. 131.

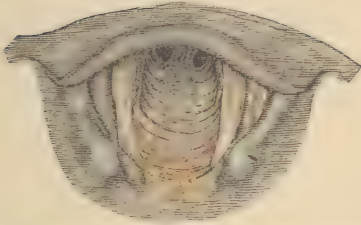
³ Transactions of the American Laryngological Association, 1870.

⁴ L. Réthi, Transactions of the Ninth International Medical Congress, 1887.

⁵ Archives of Laryngology, vol. i. p. 65.

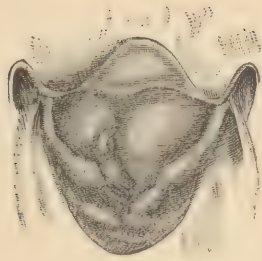
PLATE I.

FIG. 16.



Chronic atrophic laryngitis, showing crusts adhering to vocal bands and posterior wall of trachea (Ives).

FIG. 17.



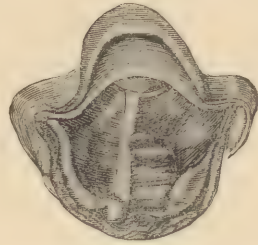
Injury from contusion (J. H. Packard).

FIG. 18.



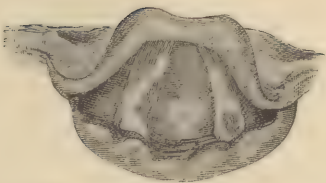
Scabbing-over of the mucous membrane after application of nitric acid (Türk).

FIG. 19.



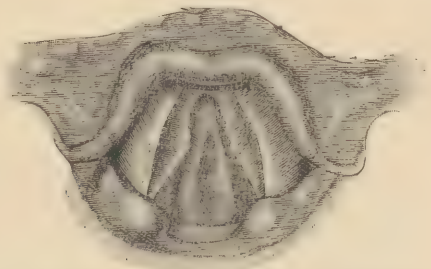
Gun-shot wound of larynx, left side (Daly)

FIG. 20.



Catarrhal ulceration of vocal cords (Türk).

FIG. 21.



More extensive ulceration, probably catarrhal (Türk).

Bean,¹ Lennox Browne,² and Schnitzler³ have reported a hemorrhage into one of the vocal bands.

Clots are often seen in the larynx from hemorrhage of the bronchi or lungs. In such cases the clots will be found most often clinging loosely to the edges of the ventricular or vocal bands in dangling shreds, while similar clots may be seen along the walls of the trachea. Sometimes, however, after a severe hæmoptysis the upper surface of the ventricular and vocal bands will be found well covered with tolerably firm coagula.

A laryngeal hemorrhage, as Réthi says, may not always be associated with an inflammation, especially when occurring during menstruation (Browne) or when occurring in the so-called bleeders.

The laryngeal appearance in the *atrophic* form is characteristic. In the first place, the laryngeal opening is large. The ventricular and vocal bands are thin, the former rather paler than natural, and glistening. Small scales of dried secretion may be observed on the vocal bands and clinging about the inter-arytenoid region, even down on the posterior wall of the trachea. (Plate I., Fig. 16.) There may be a fetid odor (Cohen) to these scales. The whole lining membrane appears thin, with possibly some enlarged veins or capillaries crossing the surface.

PATHOLOGY.

Chronic catarrhal inflammation of the larynx, although generally believed to be a consequence of the acute form, may come on so insidiously as never to have shown the pathological steps of an acute inflammation. Green⁴ says that "chronic catarrhal inflammations of mucous membranes differ from the acute, inasmuch as the subepithelial connective tissue is often extensively infiltrated with small cells which may ultimately form an imperfectly fibrillated structure."

Delafield and Prudden,⁵ speaking of chronic catarrhal inflammation, say, "This form of inflammation is regularly attended with structural changes which are evident after death. But yet these changes are not always in proportion to the symptoms observed during life. The excessive production of mucus and pus which exists during life is not necessarily attended with marked changes in the mucous glands or blood-vessels."

Payne⁶ says, "Chronic inflammation may begin suddenly or rapidly like the acute form, or else may come on insidiously and gradually, but differs in this, that instead of undergoing spontaneous decline it will remain for a long time at a certain level of intensity, neither getting worse nor entirely going away, like a curve approaching its asymptote. . . . It is

¹ Transactions of the American Laryngological Association, 1887, p. 195.

² Transactions of the Ninth International Medical Congress, 1887.

³ Archives of Laryngology, vol. ii. p. 90.

⁴ Pathology and Morbid Anatomy.

⁵ Handbook of Pathology and Histology.

⁶ General Pathology.

obvious that the distinction is one of degree, and that the line is sometimes very difficult to draw. . . . Chronic inflammation in general shows less hyperæmia with its attendant phenomena, while the exudation, cell-migration, and possibly other tissue-changes, remain."

Although these general descriptions very aptly apply to many cases of idiopathic chronic laryngeal catarrh, yet its course and effects establish several distinct morbid states which are probably due to the nature of the region or organ involved, and which need special attention. Thus, we meet with chronic hyperæmia without much if any structural change, which may continue for an indefinite time. This is especially met with in public speakers and singers who use the voice almost daily. It undoubtedly depends upon an extra vascularity not wholly transcending the physiological state. In time it ought to lead to a pathological state,—hyperplasia; yet this does not always happen, if the patient be duly careful of his general physical welfare.

I have met with several such cases. One in particular, which I will mention, was in the person of an actor whom I had under observation from time to time during a period of about fifteen years. Although his larynx always presented the appearance of hyperæmia, there was never presented the laryngoscopic evidence of hyperplasia to any extent, except during acute exacerbations.

I am aware that the majority of pathologists hold, and with good reason, that there can be no permanent congestion (hyperæmia) without inflammation and all that such a state implies,—viz., exudation, etc. Yet it is not unreasonable, in the light of clinical observation, to hold an opposite opinion. Perhaps no explanation acceptable to a critical scientific mind can be offered; yet when we reflect upon the exceptional vascularity of mucous membranes, and consequently the vast vaso-motor nerve-distribution attendant thereon, keeping in mind the subtle and anomalous physiological and pathological operations which these nerves, through the ganglionic system, initiate and supervise, as exemplified by the numerous curious effects of reflex action, etc., it is not difficult to believe that mucous membranes may be endowed, under certain circumstances, with exceptional neuro-vascular resistance to tissue-lesions; in other words, that rapidity and endurance of vascular reaction may prove quite sufficient from time to time to maintain a sort of equilibrium with the exciting irritation, in conformity with the old proverb that "nature can get used to almost anything."

Hyperplasia.—The thickening is usually due to exudation in the submucosa and enlargement of the blood-vessels, with proliferation of connective tissue elements.

These changes may be general or confined to certain portions of the larynx.¹ The exudate may be so little or be so evenly distributed as to

¹ Roe, American Laryngological Association, 1879, p. 297.

cause little alteration of the physical characters, and its absorption so partial as to leave the texture nodular and uneven.

Cedema so called is not in chronic laryngitis a serous effusion, as in the acute disease, but a veritable hyperplasia, undergoing fibrillar changes. The exudation is composed largely of lymph and cellular elements, with some serum. The latter, however, becomes gradually absorbed, leaving the other elements to either break down or become organized, thus constituting hypertrophy. Any continued strangulation of the vessels or extra formation of fibrous tissue will suffice to alter these conditions and lead to contraction and atrophy.

Chronic cedematous laryngitis is often incident to deep-seated inflammations, such as perichondritis, or semi-chronic suppurative inflammations.

In *laryngitis hypertrophica inferior* the whole glandular apparatus is very much enlarged and changed, while the perivascular spaces are more or less occupied with new tissue or new vessels.¹ The secretion in this form is also altered. In the condition known as trachoma, or chorditis vocalis tuberosa, there is at first glandular (follicular) hyperplasia, and afterwards epithelial proliferation. Rice believes this condition to be identical with pachydermia, and he with others thinks it is in some way connected with inferior hypertrophy.

Pachydermia.—This condition was first described by Virchow, who recognized two forms, one of a syphilitic nature, the other the result of simple chronic inflammation. Dr. Julius Sommerbrodt² and Dr. Rheiner³ state that this process undoubtedly occurs under the influence of a chronic catarrhal inflammation in which a thickening of the epithelial scales takes place.

Gottstein⁴ speaks of a verrucous and a diffuse form. Under the latter he evidently includes trachoma of the vocal bands, and he is supported in this by Rice.⁵ This peculiar formation is accounted for by some (Schroetter⁶) upon the same theory as that of the origin of trachoma of the vocal bands, viz., friction between the opposite edges, after nodules have been formed. This, it seems to me, is a more plausible explanation of the origin of pachydermia than of trachoma. It is reasonable to suppose that a small projection or two in the region of the posterior vocal processes would result in further growth by continual irritation from friction, on account of the great mobility of these parts during phonation.

Chorditis Vocalis Tuberosa of Türk (Trachoma of Mackenzie).—Ziemssen⁷ and others consider this condition a "dermoid metamorpho-

¹ Donaldson, Transactions of the American Laryngological Association, 1888, p. 16.

² Berliner Klinische Wochenschrift, 1890.

³ Ibid.

⁴ Die Krankheiten des Kehlkopfes, 1890.

⁵ Transactions of the American Laryngological Association, 1890, p. 101.

⁶ Die Krankheiten des Kehlkopfes, 1891.

⁷ Cyclopædia of the Practice of Medicine, vol. iv.

sis;" and Gouguenheim¹ believes all these cases to be very much the same as papillary development elsewhere. Rice² has found chondritis tuberosa associated with subglottic hypertrophy.

S. Gross³ contends that some cases reported as hypertrophic inflammation are instances of primary "laryngosclerema," demonstrated by microscopical examination showing the presence of bacilli known as the bacteria of ordinary rhinosclerema.

E. Meyer reports eleven cases of pachydermia laryngis, all involving the posterior part of the vocal bands. He doubts any association of the lesion with either syphilis or tuberculosis; while O. Chiari, on the other hand, believes he has seen the disease produced by both syphilis and tuberculosis, as well as by chronic catarrh, in alcoholic drinkers. In cases of diffuse infiltration of the inter-arytenoid region he has found the epithelial layer thickened to five or six times its normal dimensions.

Under the title of "A Case of Hard Warts (*Verruca Dura*) of the Larynx," P. Bergengrün reports a case without a trace of either syphilis or tuberculosis in personal or parental history. The pharyngeal mucous membrane was dry. The larynx showed intense chronic catarrh. The lining of the left ventricle was especially swollen and deeply injected, covering the greater part of the left vocal band. There was intense bilateral subchordal swelling. The mucous membrane over the arytenoids and inter-arytenoid region was greatly swollen; from the latter arose a number of whitish warty prominences, some of them the size of a small pea, their surface slightly irregular. Palpation with a sound conveyed the idea of very dense consistence. They were sessile and movable, and therefore not attached to the basement tissues. Microscopic examination of the incised masses showed "exclusively the epidermoidal characteristics of hard or corneous warts,—a vascular connective tissue, from which vascular papillary outgrowths extended, finger-like, towards the periphery, with distinct zones of small-celled infiltration in the enveloping epithelium of the neighboring portions of the generally acellular connective tissue of the neoplastic formation, and with a group of round cells in the centre, some arranged in stripes, some in circles, some in smaller or larger spindle-shaped groups lying beside one another." The development and hardening of the epithelium were especially distinct.

Atrophic Form.—There is a marked diminution in the number of the vessels, glands, and basement tissue of the mucous membrane. It is often accompanied by atrophy of the nasal or pharyngeal mucous membrane, but may be seen as an independent condition. The whole lining structure of the larynx is thin and pale (Audebert),⁴ and on section under the microscope shows obliteration of some of the vessels and loss of the glandular

¹ *Annales des Maladies de l'Oreille et du Larynx*, August, 1890, p. 511.

² *Transactions of the American Laryngological Association*, 1890, pp. 102, 103.

³ *Annual of the Universal Medical Sciences*, 1889.

⁴ *Annales de la Polyclinique, Bordeaux*, July, 1889.

elements of the submucosa, with which appear interwoven a few laminations of fibrous tissue. There is increased pigmentation. Moure¹ considers the epithelial layer the early seat of the disease.

Green,² speaking of the changes after infiltration of the connective tissues in chronic catarrhal affection, says, "The membrane thus becomes indurated and thickened, and the pressure exercised by the new growth may induce atrophic changes in the glandular structures which it contains."

Hemorrhagic Form.—Increased vascularity in whole or in part characterizes the lining membrane of the larynx, with increased number and size of the vessels, the walls of which in very chronic cases are thinner than normal and lie loosely embedded. In other cases the principal change seems to be in the epithelium, which is soft and fragile, easily separating from the subjacent layers. Small erosions or ulcerations are sometimes shown in spots (Schnitzler, Lennox Browne).

CHRONIC LARYNGEAL CATARRH OF TRAUMATIC ORIGIN.

The injuries to the larynx may be direct, such as fracture or luxation of the laryngeal cartilages, contusions, foreign bodies in the laryngeal cavity, —fish-bones, seeds, pins, etc. (Langmaid³),—chemical irritants, and wounds; or indirect, through injuries to neighboring parts, such as the hyoid bone, the tongue, the pharynx, the œsophagus, or the vertebral column. Chronic inflammation of the mucous membrane of greater or less extent may follow any of these (Langier⁴). Very severe injuries to the larynx are usually followed by death, persons often dying suddenly from a blow over the larynx (Marschka⁵). I believe there are only three or four cases on record of recovery from fracture of the cricoid cartilage.

Chronic inflammation succeeding these injuries is usually characterized by more or less extravasation of blood and œdema,⁶ subsequently hyperplasia and hypertrophy. Sometimes severe injury leaves little or no lesion (Sajous⁷).

If contusions or concussions leave any chronic change of the laryngeal mucous membrane, it is usually a general thickening or swelling accompanied by more or less disability of phonation,—even aphonia. The color presented by the membrane, however, is not intense. One case of chronic laryngeal catarrh with complete aphonia occurring after injury has been reported by Packard⁸ and Hopper.⁹ (Plate I., Fig. 17.)

¹ Le Progrès Médical, August, 1883.

² Pathological and Morbid Anatomy.

³ Transactions of the American Laryngological Association, 1887, p. 239.

⁴ Des Fractures du Larynx.

⁵ Archives of Laryngology, vol. iii. p. 88.

⁶ Transactions of the London Pathological Society, vol. xl.

⁷ Archives of Laryngology, vol. iii. p. 249.

⁸ Ibid., vol. i. p. 56.

⁹ Ibid., vol. ii. p. 57.

Fractures of the thyroid, when they do not cause death at once, are liable to leave a chronic inflammation with permanent structural change about the locality of the injury (Roe¹), which may entirely disable the vocal or ventricular band of that side, and even cause more or less stenosis. An interesting report of a case of extravasation and thickening from fracture of the thyroid cartilage is reported by G. Baring.²

Luxations usually leave a chronic inflammation of the mucous membrane for an indefinite time, and will certainly do so if occurring often, as in the case related by Braun,³ and in one by Wolf.⁴ Foreign bodies in the larynx may lead to a phlegmonous inflammation, which in turn induces a chronic inflammation. Volatile chemical irritants, such as ammonia, phosphorus, etc., and caustic solutions of zinc chloride, silver nitrate, chromic, acetic, carbolic, or nitric acid, iodine, etc., when accidentally or carelessly applied will surely bring about a chronic laryngeal catarrh, if nothing more than that (Plate I., Fig. 18). I have seen several cases of extensive disease which has been thus produced.

Wounds, gun-shot (Daly⁵ (Plate I., Fig. 19), Solis Cohen⁶), incised, etc., usually leave a certain degree of structural change which is apt to terminate in a general chronic catarrhal inflammation. A case of hæmatoma of the ary-epiglottic fold following a wound has been reported in the *Archives of Laryngology*;⁷ a stab-wound with persistent aphonia has been reported by Lefferts,⁸ and a stab-wound of the left vocal cord producing continued local inflammation by F. Semeleder, Mexico.⁹

Fracture and disease of the hyoid bone (Daly,¹⁰ A. Lane¹¹), foreign bodies in and injuries of the œsophagus, either from neuro-vascular sympathy or from contiguity, almost always produce a certain amount of laryngeal inflammation.

Injuries, tumors, and foreign bodies at the base of the tongue, as in a case reported by Seiler,¹² also lead to this affection. Laceration of the larynx may lead to a chronic inflammation, as in a case of laceration of the right laryngeal sinus reported by J. C. Morgan.¹³

Caries and other diseases of the vertebral column have been known to produce chronic laryngeal catarrh. Perichondritis and necrosis of the cricoid cartilage are sure to do so.¹⁴

¹ *Archives of Laryngology*, vol. ii. p. 127.

² *Birmingham Medical Review*, 1891.

³ *Berliner Klinische Wochenschrift*, May, 1890.

⁴ *Annual of the Universal Medical Sciences*, 1892.

⁵ *Transactions of the American Laryngological Association*, 1884, p. 47.

⁶ *Ibid.*, 1884, p. 57.

⁷ *Ibid.*, vol. ii. p. 192.

⁸ *American Journal of the Medical Sciences*, July, 1881.

⁹ *New York Medical Record*, August, 1890.

¹⁰ *Archives of Laryngology*, vol. i. p. 162.

¹¹ *London Lancet*, May 7, 1885.

¹² *Archives of Laryngology*, vol. ii. p. 276.

¹³ *Ibid.*, vol. iii. p. 88.

¹⁴ M. Cartier, *Archives des Maladies de l'Oreille et du Larynx*, vol. i. p. 344.

DIAGNOSIS.

The diagnosis of the several forms of chronic laryngitis from laryngeal and pulmonary phthisis, syphilis, carcinoma, lupus, and adenitis, and from some of the benign neoplasms, is not always an easy task.¹

In the diagnosis from phthisis or tuberculosis in the earlier stage the clinical history will be of great service. We seldom see cases of this nature without more or less constitutional disturbance, rapid pulse, pyrexia, etc. While the laryngoscopic appearances are often similar in phthisis and in chronic laryngitis, there is usually a paleness of the membrane, with or without a pyriform swelling of the arytenoids ("clubbing"), in the former. In the so-called hyperæmic or inflammatory form of laryngeal phthisis, while the color is intense, the swelling of the mucous membrane is far greater than in simple laryngitis, and is especially observable at the arytenoid projections; while small ulcerations of irregular outline in this situation, or on the epiglottis, or on the ventricular or vocal bands, may serve to differentiate. In the later stages the diagnosis becomes easier, owing to the characteristic structural changes belonging to laryngeal phthisis.

The œdematous form may be easily confounded with any of the syphilitic forms of local disease, because aggravated hyperplasia of this sort is common to them,—indeed, is more often seen than in connection with the simple affection. Therefore differentiation will often depend largely upon the history of the case.

Hypertrophy, superior or inferior, may be distinguished from carcinoma and lupus by the color, lupus showing a high degree of redness with a granulated surface, carcinoma less redness, but with an uneven surface, while in hypertrophy the swelling is pale, smooth, and even.²

Between the early (erythematous) stages of secondary syphilis and chronic laryngeal catarrh there is a resemblance, so that in some instances the clinical history of the case will have to be depended upon.

Generally, however, the redness and swelling of syphilis will be confined to a few patches, where perhaps a sharp look may discover the initial softening of ulceration. When ulcers are present, they will add to the probability that the inflammation is a specific one.

From tertiary syphilis there will be little trouble in distinguishing chronic laryngeal catarrh, for the structural changes will be characteristic.

The differentiation between erosion and ulceration is not always easy, because both lesions sometimes occur in this affection,—although not often (Plate I., Figs. 20 and 21).

The superficial character, and the absence of an inflammatory areola, together with the clinical history, will serve to determine the character of these lesions, especially if the patient be kept under observation for a few

¹ Delavan, Transactions of the American Laryngological Association, 1890.

² Transactions of the American Laryngological Association, 1881, pp. 70-76.

days. When ulceration occurs with considerable hypertrophy it is much more stationary than is ulceration in either syphilis or tuberculosis, in which diseases the process is usually rapid and deep-seated.

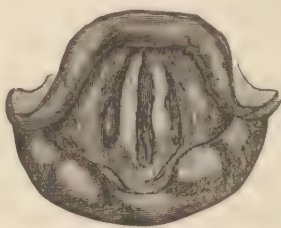
Chronic rheumatic laryngitis and perichondritis of the arytenoids (Figs. 22, 23, and 24) may resemble each other at first (Shurly¹), but soon the

FIG. 22.



Perichondritis of the left cricoid: unopened abscess (Türk).

FIG. 23.



The same (Fig. 22) after opening of the abscess (Türk).

FIG. 24.

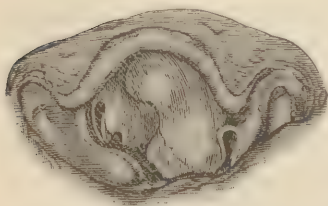


Perichondritis laryngis (Burow).

intensity and extent of the swelling, and the presence of more or less pus or muco-pus about the swelling, together with the clinical history of the case, will serve to distinguish the former from the latter. The constitutional disturbance may be considerable with either affection.

Enchondrosis (Fig. 25) and chronic œdematous laryngitis may appear alike in the laryngoscopic mirror, but the circumscribed contour and smooth surface, together with the sense of hardness conveyed by the probe, will solve the question of diagnosis.

FIG. 25.



Laryngeal appearance of enchondroma (Türk).

Inferior hypertrophy may sometimes be mistaken for an accumulation of desiccated secretion below the vocal bands, but the smooth rubber-like surface of the projection, moving with the vocal bands, together with a certain degree of dyspnoea,

will serve to determine the difference. It is sometimes difficult to differentiate between this form of hypertrophy and a membranous formation which is the result of congenital malformation or injury. Organic disease at the roots of the motor nerves of the larynx causing paralysis of the posterior crico-arytenoid muscles (Cohen,² Krauss,³ Semon⁴) may be mistaken for hypertrophic or pachydermic laryngitis, especially by their subjective symptoms; but careful laryngoscopic examination, although hyperæmia and swelling be present, will serve to show the paralytic character of the affection.

¹ Transactions of the Ninth International Congress, 1887.

² Diseases of the Throat.

³ Annales des Maladies de l'Oreille et du Larynx, vol. xii. p. 530.

⁴ Ibid.

Prolapsus of the ventricular bands (Elsberg,¹ Cohen,² Lefferts) may be mistaken for superior laryngeal hypertrophy or some neoplasm, or for angioma laryngis. Laryngoscopic examination with the aid of a laryngeal probe will show the place of attachment as well as the character of the swelling.

Angioma can be differentiated from hemorrhagic laryngitis by the profuseness of the hemorrhage and the firm localized patch of blood-vessels elevated above the surface. It differs from a fibrous or cystic growth in its color and contour, being flat, and as it were diffuse, and from lupus and epithelioma by the apparent evenness of its surface.

Such a formation cannot be taken for phlebectasis laryngis, because in the latter condition the veins can be easily made out.

Papillomata can be differentiated from chorditis vocalis tuberosa by their color, size, and distinct attachment.

Trachomatous projections appear as a line of little white papules projecting above or from the edges of the vocal cords.

Exaggerated dimensions of the laryngeal ventricles may be mistaken for the atrophic variety of laryngeal catarrh, but the absence of dried secretion (crusts) on the surface, and a uniform pink color, will be the distinguishing features between the two.

COURSE AND TERMINATION.

Idiopathic chronic laryngitis may continue for years without giving rise to serious structural change. Many authors believe that the disease is sure to extend along the respiratory apparatus and terminate in some form of phthisis pulmonalis or tuberculosis.

According to late pathological theories concerning the bacterial origin or cause of pulmonary phthisis, such a result would appear inevitable, because of the suitable soil for the implantation of germs which such a pathological condition would afford,—especially in the event of *ulceration*, which, according to Schnitzler³ and Fraenkel,⁴ proves to be good ground for bacterial invasion.

However, the clinical experience of the world in laryngology must show emphatically the error of such views by the great number of the subjects of chronic laryngeal catarrh who are never affected with either laryngeal or pulmonary phthisis. Nevertheless, such a termination does take place in a given number of cases, the inflammatory or catarrhal form of phthisis pulmonalis supervening. In our experiments upon monkeys with dried sputum, Dr. Gibbes and myself have not been able to observe any particular laryngeal lesions, although by insufflation the sputum must have been lodged on the laryngeal walls.

¹ Archives of Laryngology, 1886.

² Ibid.

³ Ibid., vol. iii. p. 18.

⁴ Manual of Pathology, 3d ed.

Ulceration is not frequent in the course of simple chronic laryngitis, and its occurrence is taken by many to indicate the tubercular or syphilitic nature of the case.

Tymowski¹ thinks that statements to this effect are far too sweeping, and believes from abundant careful observation that he is able to refute them.

In the chronic hyperplastic form called œdematous, ulceration is not so uncommon, because of the continual pressure and injury to which some of the parts are exposed. This is particularly so with the epiglottis and the arytenoid projections, which not only are the most common seat of exudation, but are also more exposed to injury or irritation.

Erosion or aphthous ulceration, especially of the epiglottis or of the vocal bands, is quite often seen in the course of the disease (Gottstein²), sometimes, but seldom, leading to ulceration extending to the submucous tissues. Fritsche³ relates a case of ulceration which he thinks was caused by gastric juice.

These abrasions are generally of transitory duration, and are confined to the epithelial layer. They may be observed in connection with the so-called "dartrous diathesis" of the older French authors. Gottstein relates a case of laryngeal œdema caused by the formation of phlyctenulæ.

Perichondritis seldom occurs incidentally to chronic laryngitis of non-specific origin, except when due to some of the infectious diseases, such as typhus fever, small-pox, etc. In a case of typhus fever in a Belgian emigrant who came under my observation some years ago, a persistent chronic laryngitis supervened. Hyperplasia continued after recovery from the fever, and about six months thereafter I was called to see him again and found him suffering from a severe perichondritis of the left arytenoid cartilage. Suppuration took place, and an abscess formed: the pus was liberated by incision. No exfoliation of cartilage ever followed this, but there was eventually almost complete immobility of the part. (See Figs. 22, 23, 24, and 25.)

Dr. David Newman⁴ relates an interesting case of suppurative perichondritis without antecedent laryngeal disease or traumatism. It is said rarely to occur as an independent affection (von Ziemssen⁵). C. Gerhard⁶ reports a case of cricoid perichondritis, supposed to have been caused by long-continued decubitus, in which there was chronic laryngeal catarrh.

L. Brieger⁷ gives among the causes of laryngeal perichondritis chronic

¹ Transactions of the French Society of Otology and Laryngology, May 23, 1890.

² Krankheiten des Kehlkopfes, 1890, p. 295.

³ Archives of Laryngology, vol. ii. p. 190.

⁴ British Medical Journal, March, 1890

⁵ Cyclopædia of the Practice of Medicine, vol. iv. p. 220.

⁶ Archives of Laryngology, vol. i. p. 19.

⁷ Ibid., vol. iii. p. 86.

laryngitis attended with considerable hyperplasia. Schroetter,¹ Gottstein,² Lennox Browne,³ and others state that although perichondritis is more often secondary to tuberculosis, syphilis, erysipelas, arthritis, etc., yet it is frequently met with as a primary affection, they believe, as a result of cold or general infection and structural degeneration.

Three cases of perichondritis with ulceration occurring in the course of chronic laryngitis following convalescence from small-pox and typhoid fever are reported by Mr. Eve in the Transactions of the London Pathological Society for 1881.

Suppuration and abscess are not common in the course of chronic laryngitis, except in the case of severe exacerbations from cold or intercurrent diseases. It is therefore highly probable that a person in whom chronic laryngeal catarrh exists will be more liable to severe laryngeal complications, such as suppuration, ulceration, or perichondritis, if attacked by any of the acute infectious diseases.

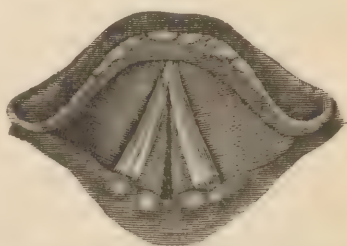
A case of dangerous œdema of the larynx becoming chronic came under my observation in a lawyer who had contracted a pernicious malarial fever in the South, and who had been afflicted for several years previously with chronic laryngeal catarrh.

Hypertrophy, either superior or inferior, is apt to supervene in the course of this disease. Any prolonged local irritation in the hyperplastic form may lead to it. Dissipated or ill-nourished persons furnish the greatest number of examples. More or less stenosis, and consequently dyspnoea, supervene, and tracheotomy may become necessary (Figs. 26, 27, 28); although the individual will get along comfortably with a considerable amount of stenosis, provided it come on gradually.

Atrophy may result as a sequence of hypertrophy (Green,⁴ Gibbes⁵). Indeed, many observers say that it is the inevitable result of hypertrophy or hyperplasia here as well as in the nasal passages and pharynx. However this may be in some cases, it is certainly not true of all, for we often meet with all the laryngoscopic appearances of atrophy without any previous history of hyperplasia. Important changes in the ventricle occur both in this and in the hypertrophic form.

Hemorrhagic chronic laryngitis is *sui generis*, and must not be confounded with laryngeal hemorrhage. The latter condition may attend almost

FIG. 26.



Chondritis inferior vocalis hypertrophica following typhus fever, showing membranous growth on under surface of the vocal bands (Burow).

¹ Krankheiten des Kehlkopfes, p. 117.

² Ibid., p. 155.

³ Diseases of the Throat, p. 292; Journal of Laryngology and Rhinology, 1888, p. 377.

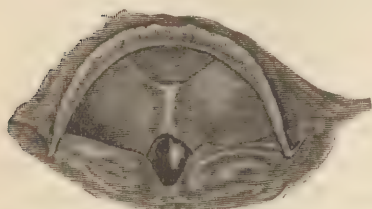
⁴ Ibid., 1891.

⁵ Practical Pathology and Morbid Histology, 1891.

any case of chronic laryngitis, especially if erosion or great localized swellings occur. These cases are apt to terminate in anæmia or general lymphangitis which slowly leads to death.

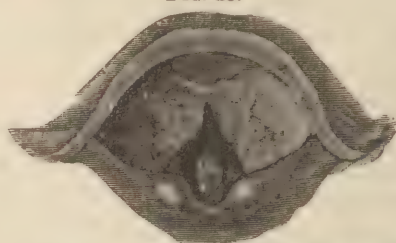
Permanent immobility of the vocal bands from interstitial deposit

FIG. 27.



Membranous stenosis of the larynx the result of typhoid fever (Burow).

FIG. 28.



Membranous stenosis of the larynx (same as Fig. 27), showing effects of treatment,—incision and dilatation (Burow).

either in the muscles or about the arytenoid articulations is a frequent termination of this disease, of course resulting in more or less loss of voice and embarrassment of respiration. It not infrequently happens that spasmodic asthma results from the long-continued laryngeal inflammation.

Angioma of the larynx (Glasgow¹), varix,² and cystic tumors³ may result from this disease. Papillomata are frequently the result or accompaniment of chronic laryngeal catarrh,—especially in children. Although neoplasms are said to cause this disease, it is doubtful whether myxoma ever causes it.

TREATMENT.

The treatment for this affection may be conveniently considered according to the following scheme:

General	{	Medicinal.
		Hygienic.
		Climatic.
Topical	{	Medicinal.
		Mechanical.
		Surgical.

General.—Medicinal.—The selection of medicinal agents for internal administration will depend, of course, upon the systemic condition of the patient, keeping in mind the cardinal point of removing as far as possible all causes. It will be frequently observed that general treatment is more efficacious than topical. Therefore any functional derangement of the body must be strictly attended to, especially those pertaining to the cholopoietic viscera, the nervous system, the skin, and, in females, the sexual organs. The relief of a subacute gastric catarrh, of a constipated habit, or

¹ Transactions of the American Laryngological Association, 1888, p. 146.

² Thomas, Archives of Laryngology, vol. ii. p. 194.

³ Brandeis, Archives of Laryngology, vol. iii. pp. 170, 187.

of some ovarian or uterine disorder will often be the only treatment required for the milder forms of this disease.

While it cannot be positively asserted that any of the remedies in vogue have a selective action on the laryngeal mucous membrane, yet it is a matter of frequent observation that certain drugs, such as iodine and its compounds, ammonium muriate, belladonna, xanthoxylin, preparations of phosphorus, aconite, mercury biniiodide, antimony tartrate,¹ lobelia, hydrastin, balsams, and turpentine and its compounds, do show decided effects in this direction.

Hygienic.—Hygienic treatment, it is obvious, is important. The patient ought to be removed from damp, overheated, or other bad domiciliary surroundings.

All bad habits of living should be interdicted, such as the use of tobacco or of alcoholic or malt liquors in excess, late hours and evening air, over-eating, especially of highly-spiced or rich food, and sedentary in-door life. Dusty and otherwise noxious vocations should be modified. The skin should be kept moderately active, by means of exercise, soap baths, and friction occasionally, though not too often. The daily sponging of the neck and chest with cold water to render them more obdurate to external impressions or cold air, as suggested by Brown-Séquard, and the abandonment of the very harmful practice of wearing chest-protectors in-doors, should be insisted upon.

The beneficial effects of the renunciation of bad habits in cases of chronic laryngeal catarrh are strikingly exemplified by the fact, as related to me by Dr. Lathrop (late physician to the Michigan State Prison), that persons suffering from this disease when committed to prison will very often be found to have recovered after being immured for some months without having been under any particular medical treatment.

Climatic.—In the present state of climatological science it is impossible to lay down any precise rules of guidance. In this respect each individual is “a law unto himself.” In general, however, a warm moist climate is beneficial. Those cases which exhibit considerable secretion do better in a dry warm climate of moderate altitude, unless it be very dusty. Ingals, in a valuable paper read before the American Climatological Association on the effects of dry atmosphere on the larynx and nose, says that the injurious effects in these cases may be attributed partly to the dryness of the atmosphere (from its effects on the nervous system), and partly to the irritating dust often found in high altitudes, and, further, that “a high and dry atmosphere is usually injurious to persons suffering from chronic laryngitis, but is beneficial in exceptional cases.”

Cold climates, whether dry or moist, are not beneficial, as a rule, to cases of chronic laryngeal catarrh attended with any degree of hyperplasia. But the hemorrhagic and atrophic varieties are exceptions, for I have known of several persons suffering with the latter that were so materially benefited

¹ Cohen, Transactions of the American Laryngological Association, 1889, p. 89.

by a residence in the "Lake Superior region" as to think they were radically cured of it.

The following letter from Dr. John Traill Green was in reply to my request for information as to the climatic effects of Tucson, Arizona, and its vicinity, on lesions of the larynx:

"1. Laryngitis in any form—acute, subacute, or chronic—is rarely met with.

"2. Even when tuberculosis does develop here in the lungs or other organs, it rarely attacks the larynx.

"3. Out of two hundred cases of tuberculosis examined in the last three years in patients from damper climates, not more than ten have shown laryngeal symptoms, and none of these developed here.

"4. Tubercular patients have left here and gone to other climates and returned with the larynx affected.

"5. As far as experience shows, the warm dry air of this region, and the comparatively low altitude (two thousand four hundred feet), are of the utmost benefit to all lesions of the larynx.

"6. The warmer and dryer the air the better. Even patients suffering great pain from ulceration notice the most relief on the hot, dry, still days of the summer months.

"7. An 'all-year-round' residence should be insisted on in all cases.

"8. Laryngeal patients should never go higher than five thousand feet, and many cannot even stand that altitude."

Mineral waters have been recognized for many years as very beneficial in the treatment of chronic laryngeal catarrh. Among the plethoric and sedentary, especially after the age of forty-five, there is probably no class of remedial agents more valuable than the saline mineral waters taken internally and applied externally as baths. Likewise in cases of anæmia the chalybeate waters are of great value. When used locally as spray, however, their value is questionable.

The effects are more noticeable when the patient resides at the springs than when the same water is used at home. Therefore due credit must be given to the essential features embraced by the change of scene, including, perhaps, change of habits and relief from worry which may be incident to a sojourn at a watering-place.

Galvanic electricity may prove of great value. Dr. H. A. Johnson¹ records several cases of chronic laryngitis with aphonia which were greatly benefited by systematic treatment with the galvanic current. The mental effect in some cases complicated by functional nervous diseases is marked. I know of the case of a lady suffering with chronic laryngeal hyperæmia, probably due to functional disturbance of the ganglionic nervous system, who was supposed to have recovered through the application of the galvanic current made to the region of the neck daily for a period of ten

¹ Transactions of the American Laryngological Association, 1885, p. 82.

days. But it was afterwards discovered by her physician that, owing to a defect in one of the electrodes, the circuit had never really been closed.

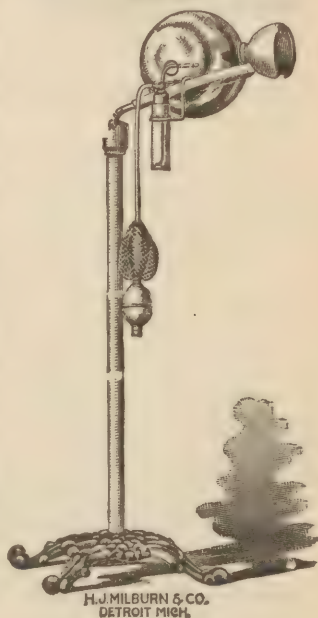
Topical.—The topical treatment may be carried out by means of sprays (aqueous and oleaginous), inhalations of medicated vapors, pigments, powders, and external applications.

The great difficulty in local treatment consists in the application often enough of medicaments to the laryngeal cavity by the patient or nurse. It is a well-known fact, as pointed out by Cohen¹ and Roe,² that much of the spray from any sort of apparatus directed toward the laryngeal cavity is condensed upon the fauces, soft palate, tongue, or mouth, and therefore does not gain access to the laryngeal mucous membrane at all. In fact, unless pains be taken to train the patient to quick inspiratory efforts, the only effects to be expected from this mode of treatment are of purely reflex or vicarious nature. To be effective, the spray should be driven directly in through a down-spray tube held over the laryngeal opening. These defects are overcome, however, in great measure by the use of a globe into which the spray is propelled and to which some sort of mask, enclosing the nostrils and face, is attached, as shown by the accompanying cut (Fig. 29).

With this apparatus more or less of the medicament, especially if it be oleaginous, must enter with the tidal air, since the whole act of respiration is carried on through the globe and attached rubber face-shield. In this way, oleaginous, balsamic, and aqueous solutions can be easily inhaled by the patient. The steam atomizer (that made by Codman & Shurtleff is the best) will also be of service, if the patient be instructed to close the nose during inspiration. The same instruction should be given in the use of a hand-ball atomizer.

Medicated vapors, as advocated by Lennox Browne,³ are of great utility. These may be given by means of a hot-water inhaler consisting of a receptacle capable of holding about a quart, and containing one pint of very hot water to which has been added the medicament. By acts of inspiration the patient draws air down the little openings of the cover and through the mixture and up into the mouth through the inhaling-tube at the top. There are many devices for the accomplishment of this, perhaps the best being the "Eclectic," a porcelain inhaler

FIG. 29.



Shurly's face-shield inhaler.

¹ Treatise on Inhalations, 1874.

² Transactions of the American Laryngological Association, 1887.

³ Diseases of the Throat, 3d ed.

which is provided with a thermometer, and is recommended by the late Sir Morell Mackenzie. As porcelain inhalers are expensive and easily broken, cheaper ones, made of tin, as shown in Fig. 30, will answer the purpose quite as well.

For some cases the "dry" inhaler (see Fig. 31), which fits over the face

FIG. 30.



Tin inhaler.

FIG. 31.



Dry inhaler.

like a mask, and contains a sponge at the distal end for holding the medicament, may be used.

Of course only substances more or less volatile can be used in such an inhaler (the inspiratory current of air passing through is supposed to take up the medicament). The

application of the inhalation should continue at least twenty or thirty minutes.

Pigments applied in the larynx are undoubtedly the most efficient method of local treatment for a certain class of cases, such as the hyperplastic, hypertrophic, and atrophic.

This can be done through the instrumentality of a piece of sponge, a camel's-hair brush, or a pledget of cotton. Escharotics may be applied in this way, although it is far safer to use aluminum rods or a caustic-holder for such a purpose. The brush of Clinton Wagner is probably the best instrument for the purpose, although many laryngologists use equally well the cotton or sponge.

Powders are sometimes propelled into the larynx, but, as a rule, they prove irritating and harmful, while they are rarely dissolved by the secretions. With the exception of iodoform, iodol, aristol, bismuth, morphine, tannic acid, and a few other agents, their use in the treatment of chronic laryngitis has been generally abandoned.

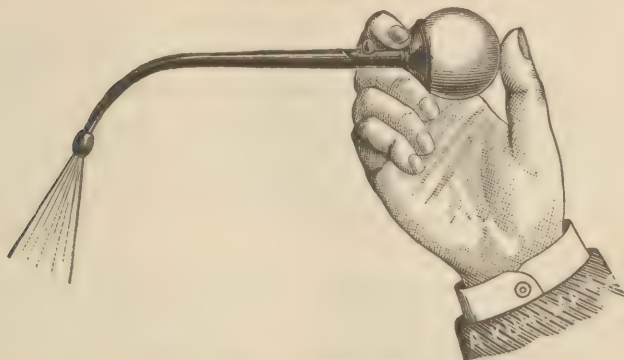
There are many forms of insufflators in the market, from simple glass tubes to elaborate bottle "powder-blowers." The disconnecting hard-rubber insufflator devised by the author some years ago, a modification of the old form of insufflator, will be found very convenient for this purpose (Fig. 32).

External applications, such as ice, hot water, poultices, blisters, and counter-irritants, as thapsia, croton oil, tincture of iodine, etc., are fre-

quently efficacious, when applied over the region of the larynx at the sides of the neck.

The treatment of particular forms of chronic laryngitis will need little

FIG. 32.



Shurly's powder-blower.

attention. At the end of this article the formulæ of several mixtures for local use are given.

Hyperæmic Laryngitis.—This form, as before mentioned, usually depends upon faulty use or overuse of the voice, or upon some vaso-motor manifestation of remote disease or perverted function.

In the former case, it is obvious that particular attention should be paid to restriction and modification of the use of the voice. *Rest*, therefore, which, as E. M. Moore says, is one-half of all therapy, should be, if possible, strictly enforced. Beverley Robinson,¹ Langmaid,² and Seiler³ lay great stress upon this measure (*rest* of the voice) in all such cases. Proper exercise of the voice by proper training is often the only therapeutic measure necessary in some cases.⁴

If the hyperæmia be kept up by disease elsewhere, of course the treatment should be directed toward the faulty region or apparatus, together with such special measures as may seem necessary. Benefit will often ensue from the administration internally of a mixture of syrup of wheat phosphates (Phillips's) and dilute hydrobromic acid, a teaspoonful three times a day in water, or fifteen to twenty minims of dilute phosphoric acid in water three times a day, or Inglis's compound elixir of fir, or Wheeler's compound elixir of phosphate of iron. If there be some relaxation of the bowels, from fifteen to twenty minims of tincture of chloride of iron in glycerin and water three times a day should be prescribed.

¹ Transactions of the American Laryngological Association, 1887.

² Ibid.

³ Ibid.

⁴ Bosworth, French, Cohen, Transactions of the American Laryngological Association, 1883 and 1890; Langmaid, Archives of Laryngology, vol. ii. p. 137, and vol. iv. p. 170.

Where there is not only loss of appetite but also slight pyrexia, a capsule containing one-fourth grain of hydrastin (white alkaloid) and three grains of cinchonidia may be taken three or four times a day, or Wheeler's compound elixir of phosphate of iron. If there be a rheumatic tendency, salicylic acid, or sodium salicylate, or salicin, may be taken three or four times daily instead.

Should the neurotic element predominate and the phosphate and acid hydrobromic mixture prove inadequate, an iron and strychnine mixture (Wyeth's) may be given, together with a dose or two at night of asafetida, ammonium valerianate, camphor monobromide, or hyoscyne hydrobromate; or one-hundredth grain of glonoin, five grains of acetanilid, or fifteen grains of sodium bromide will act nicely in allaying nervous perturbation.

If the patient be much troubled with cough, codeia with or without a little rum and syrup or syrup of yerba santa, or the compound lobelia lozenges, Hancock's or Wyeth's, may prove a needed adjuvant. It is rarely necessary to give opium, morphine, or cocaine internally. Hoffmann's anodyne or the compound spirit of chloroform will often answer as well to allay a tickling cough. Very often the inhalation of a few drops of chloroform or ether will fulfil the purpose better.

Topically only the mildest treatment is admissible. Here the meddling practitioner gets in some of his worst work. The leading local therapeutic indication is to prevent as far as possible hyperplasia and hypertrophy. Therefore, while occasionally a stimulating application may be advisable, usually all such ought to be avoided, and only the blandest medicaments, if any, used in the larynx.

The sprays of petrolina oil, albolene, vapo-petrol (Milburn's), or camphorated petrolina (Parke, Davis & Co.'s) are the best.

It is seldom necessary to brush the larynx, and almost never necessary to insufflate powders.

With professionals who are unable to procure rest of the voice, the excellent recommendation of J. Solis Cohen to use small doses of tartar emetic, and also small pieces of ice in the mouth, with cold water to the outside of the neck, should be adopted.

Hyperplastic Laryngitis.—A general thickening of moderate degree as shown by the laryngoscope calls for steady local treatment in the form of sprays and pigments. A spray of vapo-petrol, or oil of eucalyptus and petrolina, or camphorated petrolina, should be used about twice daily, unless the oleaginous nature of the remedy causes nausea. The vapo-petrol and camphorated petrolina are especially valuable. Besides this, two, three, or four times a week zinc sulphate, cadmium sulphate, zinc chloride, alum sulphate, ferric alum, silver nitrate, tannic acid, or hamamelis with a solution of potassium chlorate, should be applied directly to the larynx, either as spray or as a pigment. In practice it will be found better to apply both spray and pigment, first the spray, which will clear off the surface of the mem-

brane, and then the pigment. As a preliminary spray, a solution of sodium chloride, Dobell's solution, solution of potassium chlorate alone or with distilled extract of hamamelis, or aqua picis with either sodium bicarbonate or potassium chlorate, will be both grateful and effectual,—of course care being taken not to select the potassium chlorate, nor any chloride, if silver nitrate is to follow.

Where there is much secretion with consequent hacking, frequent inhalations of camphorated petrolina or naphthaline or creolin and petrolina will be found highly efficacious. If there be much hyperæsthesia or glottic spasm, a solution of cocaine hydrochlorate (from two to five per cent.) may be applied. This agent, very properly, is not used so much as formerly, on account of its untoward effects (J. Solis Cohen,¹ S. S. Cohen²), not only of a systemic character, but also in increasing the relaxation of the blood-vessels, as pointed out by John N. Mackenzie,³ Cohen,⁴ Asch,⁵ and others.

Menthol is a remedy of especial value for diminishing the sensitiveness of the laryngeal mucous membrane, besides being in many cases decidedly curative. A spray of ice-water is efficacious in the hemorrhagic variety as a curative agent.

When transient erosions are seen, a spray of tannic acid, followed by camphorated petrolina or creolin and petrolina or hydrargyrum bichloride, will often suffice; but if more persistent, or accompanied by pemphigus, herpes, or eczema, an insufflation of stearate of zinc, stearate of alum or tannin, iodoform, aristol with starch, or resorcin with starch, may be necessary. Silver nitrate (Cohen), although often effectual, will sometimes be of less value than the above-mentioned agents. However, when *real* ulceration occurs, silver nitrate, chromic or carbolic acid, or peroxide of hydrogen may be applied. The insufflation of iodoform, iodol, aristol, or resorcin with starch is preferable, because entailing less risk of irritation.

Chronic œdematous laryngitis requires usually the application of cold or counter-irritation to the outside, and internally the administration of mercury, iodine, or calcium sulphate, with the application of sprays and pigments containing the vegetable or mineral astringents. A spray of an aqueous extract of arbor vitæ is especially useful; also compound tincture of benzoin or creosote or iodine by inhalation from a hot-water inhaler. When exacerbations of swelling take place, especially when showing additional deposit of serum, surgical means will be necessary,—first scarification, and, if that be ineffectual, tracheotomy.

Atrophic laryngitis demands an active local treatment with stimulating agents, which will as it were stir up the flagging trophic nerves. Powders, however, are generally not admissible, because of their drying effect,—although it is urged by some that the mechanical irritation of powders

¹ Transactions of the American Laryngological Association, 1887.

² *Ibid.*, 1885, p. 138.

³ *Ibid.*, 1885, p. 142.

⁴ *Ibid.*

⁵ *Ibid.*

proves useful. However it may be in theory, in practice it is generally found that most substances so used produce unpleasant effects, by further desiccating the secretions, except, perhaps, silver nitrate and tannate of quinine, which seem to act as local stimulants without drying the secretions. Oleaginous inhalations, such as camphorated petrolina, albolene, vapor-petrol, petrolina oil, eucalyptus oil, naphthaline, thymol, oleum picis, and balsam of Peru, or a solution of mercuric bichloride in cinnamon water, will be found most useful.

In the way of pigments, those containing silver nitrate, copper sulphate, zinc chloride, iodine, balsam of Peru, and oleum picis or oil of eucalyptus, will be found curative so far as anything can be curative. The use of galvanic electricity, the naked electrode being applied to the parts, when practicable, after the plan suggested by the author and Drs. Hartman and Delavan, is probably the most serviceable. Unfortunately, however, there are many patients, notwithstanding the usually diminished sensitiveness of the laryngeal membrane in this condition, who cannot bear the treatment thus applied. Frequent applications of a small piece of dry sponge by means of an Elsberg or other sponge-holder, and the massage procedure of Bergmann and Weiss,¹ are also deserving of trial in these cases. The treatment of atrophic laryngitis, however, is usually unsatisfactory, for the obvious reason that atrophied tissue can never be restored to health.

The treatment of hypertrophy, whether general or limited, although non-specific, requires the administration of iodine or mercury, or both, as well as active local treatment. Iodine is best administered in the form of the syrup of hydriodic acid (Gardner's or Lugol's solution) in teaspoonful doses three or four times a day, or potassium iodide or ammonium iodide. Ammonium iodide will sometimes be preferable on account of its selective action upon the respiratory mucous membrane; ammonium muriate has also been highly extolled; mercurial fumigations are advocated by George E. Law² in that form of chronic laryngitis known as pseudo-membranous. Mercuric biniodide may be alternated with the iodine to advantage.

The local treatment consists for the most part in the application of iodine, mercury, or astringent pigments. Dr. Holmes³ for the treatment of that form known as chronic laryngitis granulosa advocates the use of strong mineral astringents (in pigments or powders), such as silver nitrate carried to the part upon a probe. Semon⁴ and Cohen also urge the use of strong solutions of silver nitrate in all forms of chronic laryngitis.

No special treatment seems necessary for trachoma or chondritis vocalis tuberosa, although a spray of aqueous extract of arbor vitæ is very efficient. F. I. Knight⁵ states that these proliferations may spontaneously disappear.

¹ Archives of Laryngology, vol. i. p. 290.

² Brooklyn Medical Journal, 1890.

³ Annual of the Universal Medical Sciences, 1889.

⁴ Archives of Laryngology, vol. i. p. 95.

⁵ Ibid., vol. iv. p. 282.

Cohen,¹ Rice,² and others recommend silver nitrate. Labus³ recommends flaying the mucous membrane in cases of great hyperplasia, and Heryng advocates curetting in similar cases.

Chorditis vocalis hypertrophica inferior will require about the same general treatment as hypertrophy in other situations, especially the administration of iodine or its compounds. The required local treatment when there is considerable stenosis is catheterization, as well as the application of strong astringents (Schoetz,⁴ Marian⁵). When the obstruction to respiration is very great, of course, tracheotomy must be performed without delay.

Schoetz,⁶ who gives the histories of three cases, believes that the treatment of chronic subglottic laryngitis should be begun early and actively kept up, so as to prevent hypertrophy.

The general treatment of pachydermia laryngis should be like that of hypertrophy. The local treatment will require the use of escharotics carried to the seat of trouble, or surgical measures such as evulsion. The best and safest escharotics are chromic acid, according to Sajous and Jarvis,⁷ and the galvano-cautery. The former is best carried to the part on a Jarvis laryngeal chromic-acid carrier. The galvano-cautery loop is used by Meyer. In using either of these measures great care must be taken lest the patient die of fatal spasm of the glottis. In many instances it will not be safe to make such applications without first performing tracheotomy.

FORMULÆ OF MEDICAMENTS FOR LOCAL APPLICATION.

SPRAYS.

R Hydrargyri bichloridi, gr. j;
Aquæ cinnamomi, ℥ viii-℥ xvi.—M.
Filter.

R Ammonii muriatis, gr. xl-lxxx;
Aquæ destillatæ vel
Aquæ menthol, ℥ viii.—M.
Filter.

R Extracti arboris vitæ aquosi.

R Aluminis, gr. xl-lx;
Acidi carbolici, gr. xv;
Glycerini, ℥ ii;
Aquæ destillatæ, ℥ vi —M.
Filter.

R Dobell's solution.

¹ Transactions of the American Laryngological Association, 1889, p. 116.

² Ibid., 1889, p. 120.

³ Archives of Laryngology, 1880, p. 281.

⁴ Schoetz, Archives of Laryngology, vol. ii. p. 193.

⁵ Marian, Archives of Laryngology, vol. iii. p. 88.

⁶ Schoetz, Archives of Laryngology, vol. ii. p. 193.

⁷ Transactions of the American Laryngological Association, 1888, p. 121.

- ℞ Potassii chloratis, ℥i;
Aquæ destillatæ vel
Aquæ cinnamomi, ℥viii.—M.
Filter.
- ℞ Potassii chloratis, gr. xl;
Aquæ destillatæ,
Aquæ picis, aa ℥iv.—M.
Filter.
- ℞ Potassii chloratis, gr. lx;
Aquæ destillatæ, ℥v;
Extracti hamamelidis destillatæ, ℥i.—M.
Filter.
- ℞ Sodii bicarbonatis, gr. xl-lx;
Aquæ destillatæ,
Aquæ picis, aa ℥iv.—M.
Filter.
- ℞ Argenti nitratis, gr. ii-v-x-xv-xx;
Aquæ destillatæ, ℥j.—M.
Filter.
- ℞ Cupri sulphatis, gr. v-x-xv;
Aquæ destillatæ, ℥j.—M.
Filter.
- ℞ Tincturæ ferri chloridi, ℥i;
Glycerini, ℥i;
Aquæ destillatæ, ℥vi.—M.
Filter.
- ℞ Ferri et ammonii sulphatis, gr. xl-lx;
Aquæ destillatæ, ℥viii.—M.
Filter.
- ℞ Zinci sulphatis, gr. v-x-xv-xx;
Aquæ destillatæ, ℥viii.—M.
Filter.
- ℞ Acidi tannici, gr. v-x-xv;
Alcoholis, ℥ss;
Aquæ destillatæ, ℥viiss.—M.
Filter.
- ℞ Cocaini hydrochloratis, gr. ii-v;
Aquæ menthol., ℥j.—M.
Filter.
- ℞ Aquæ creosoti.
- ℞ Olei petrolinæ.
- ℞ Albolene liq.
- ℞ Vapo-petrol. (Milburn's.)
- ℞ Petrolinæ camphoratæ. (P. D. & Co.'s.)

- R** Olei picis, \mathfrak{Z} i-ii;
 Olei petrolini, \mathfrak{Z} viii.
 Mix, with gentle heat. Filter.
- R** Creolin. (Pearson's), \mathfrak{Z} i-ii;
 Olei petrolini, \mathfrak{Z} viii.
 Mix, with gentle heat. Filter.
- R** Olei eucalypti, \mathfrak{Z} i;
 Olei petrolini, \mathfrak{Z} viii.—**M**.
 Filter.

- R** Naphthalin., gr. xxx;
 Olei petrolini, \mathfrak{Z} viii.
 Mix, with gentle heat. Filter.
- R** Thymol., gr. xxx;
 Olei petrolini, \mathfrak{Z} viii.
 Mix, with gentle heat. Filter.

PIGMENTS.

- R** Acidi tannici, gr. v-x-xxx;
 Acidi salicylici, gr. v.
 Glycerini, \mathfrak{Z} ii;
 Aquæ destillatæ, \mathfrak{Z} vi.—**M**.
- R** Aluminis, gr. x-xx;
 Glycerini, \mathfrak{Z} ii;
 Aquæ destillatæ, \mathfrak{Z} vi.—**M**.
- R** Zinci sulphatis, gr. v-x-xv-xx;
 Glycerini, \mathfrak{Z} ii;
 Aquæ destillatæ, \mathfrak{Z} vi.—**M**.
- R** Zinci chloridi, gr. v-x-xv;
 Glycerini,
 Aquæ destillatæ, aa \mathfrak{Z} iv.—**M**.
- R** Cupri sulphatis, gr. v-x-xx;
 Glycerini, \mathfrak{Z} ii;
 Aquæ destillatæ, \mathfrak{Z} vi.—**M**.
- R** Argenti nitratis, gr. v-x-xv-xx-xl;
 Glycerini,
 Aquæ destillatæ, aa \mathfrak{Z} iv.—**M**.
- R** Ferri et ammonii sulphatis, gr. x-xv;
 Glycerini, \mathfrak{Z} ii;
 Aquæ destillatæ, \mathfrak{Z} vi.—**M**.
- R** Tincturæ ferri chloridi,
 Glycerini, aa \mathfrak{Z} iv.—**M**.
- R** Resorcin., gr. x-xv-xx;
 Glycerini, \mathfrak{Z} vi;
 Aquæ destillatæ, \mathfrak{Z} ii.—**M**.
- R** Olei picis, \mathfrak{Z} i;
 Balsami Peruviani, gr. xx.
 Mix with gentle heat, and stir while cooling.

- ℞ Petrolinæ camphoratæ fortior. (P. D. & Co.'s.)
- ℞ Creosoti puri, ℥i;
Glycerini, ℥i.—M.
- ℞ Iodi, gr. v-x-xv-xx;
Potassii iodidi, q. s.;
Glycerini, ℥vi;
Aquæ destillatæ, ℥ij.—M.

INHALANTS FOR HOT-WATER INHALER.

- ℞ Tinct. benzoin. comp.,
One drachm to a pint of hot water.
- ℞ Olei eucalypti,
Half-drachm to a pint of hot water.
- ℞ Creosoti,
Ten to fifteen minims to a pint of hot water.
- ℞ Carbol. iodini (Bartholow's formula),
Ten to fifteen minims in a pint of hot water.
- ℞ Olei picis,
Twenty minims to one-half drachm in a pint of hot water.
- ℞ Spt. chloroformi,
Spt. ammonii, aa ℥i.—M.
Twenty to thirty minims in a pint of hot water.
- ℞ Tinct. menthol.,
Fifteen to thirty minims in a pint of hot water.
- ℞ Æther. sulph.,
From twenty to thirty minims in a pint of hot water.

POWDERS.

- ℞ Hydrargyri chloridi mitis,
Pulv. amyli, aa ℥ij.—M.
- ℞ Morph. sulph., gr. j;
Bism. subnit., ℥i-ij-iv.—M.
- ℞ Iodoformi.
- ℞ Iodoformi,
Bismuthi subnit.,
Pulv. amyli, aa ℥i.—M.
- ℞ Aristol.
- ℞ Aristol.,
Pulv. amyli, aa ℥i.
- ℞ Resorcin.,
Pulv. amyli, aa ℥i.—M.
- ℞ Quininæ tannat., ℥ij;
Pulv. amyli, ℥vi.—M.

- ℞ Argenti nitratis, gr. v-x;
Pulv. talci, ℥ i.—M.
- ℞ Ferri subsulph., gr. x-xx;
Pulv. talci, ℥ i.—M.
- ℞ Zinci stearat.
- ℞ Tannini stearat. cum oleo picis.
- ℞ Aluminis stearat.

FOR THE DRY INHALER.

Chloroform, tincture of iodine, ether, spirit of ammonia, and a variety of drugs may be employed.

FOREIGN BODIES IN THE LARYNX AND TRACHEA, AND IN THE PHARYNX AND ŒSOPHAGUS.

BY JOHN O. ROE, M.D.,

Rochester, New York,

Fellow of the American Laryngological Association; Corresponding Member of the
Société Française d'Otologie, de Laryngologie et de Rhinologie;
Member of the British Medical Association, etc.

PART I.

FOREIGN BODIES IN THE LARYNX AND TRACHEA.

THERE are few accidents which befall mankind of greater gravity than the introduction of foreign bodies into the larynx and trachea. As Gross remarks: "How many persons have perished, perhaps in an instant, and in the midst of a hearty laugh, the recital of an amusing anecdote, or the utterance of a funny joke, from the interception at the glottis of a piece of meat, a crumb of bread, a morsel of cheese, or a bit of potato, without a suspicion on the part of those around of the real nature of the case! Many a coroner's inquest has been held upon the bodies of the victims of such accidents, and a verdict rendered that they died by the visitation of God, when the actual cause of death lay quietly and unobserved at the door of the windpipe of the deceased."¹

A thorough knowledge of the nature of these accidents and the method of dealing with them is, therefore, of the utmost importance to every surgeon and practitioner of medicine. Often the result is so immediate that no time is given for any operative interference, and, as Louis² very justly remarked, "Art can achieve nothing when no interval elapses between a condition of perfect health and death."

In treating of the lodgement of foreign bodies in the larynx and trachea, the following arrangement of the subject will be found convenient: 1, various kinds of foreign substances which find an entrance into these passages; 2, modes of their entrance; 3, physical conditions which attend their lodgement; 4, symptoms to which they give rise; 5, methods of diagnosis; 6, prognosis; 7, spontaneous expulsion and migration; 8, treatment.

¹ Foreign Bodies in the Air-Passages, Philadelphia, 1854, p. 43.

² Second Memoir on Bronchotomy, Mémoires de l'Académie Royale de Chirurgie, 1768, tom. iv. p. 477.

VARIETIES OF FOREIGN SUBSTANCES.

Foreign bodies which find lodgement in the air-passages may be divided into *fluid* and *solid*.

1. *Fluid Bodies*.—The fluid bodies comprise articles of liquid food,¹ and drink,² the contents of tonsillar,³ retro-pharyngeal,⁴ and aryteno-epiglottic⁵ abscesses, blood⁶ entering the air-passages during surgical operations or after an injury, and chyme⁷ or other vomited matter.⁸

The conditions which predispose to the entrance of fluids are, abnormal or diseased conditions of the throat or larynx, fistulous openings between the trachea and the œsophagus, and stricture of the œsophagus, causing regurgitation of alimentary substances.

2. *Solid Bodies*.—The variety of solid bodies which find their way into the air-passages is very great. Attempts are sometimes made to classify such substances, as, for example, into animate and inanimate,—the latter including those of animal, vegetable, and mineral origin. They are sometimes grouped according to their shape into regular, irregular, hollow, and penetrating. But all such attempts at classification are futile, since any object of the requisite size and shape may enter these passages.

By far the most common objects found in the larynx and trachea are small round or flat substances, such as fruit-stones, pebbles, grains of corn, beans, coins, and buttons.

Among the most curious and interesting objects which have been found lodged in the air-passages are live fish,⁹ which were being held in the teeth while the hook was extracted; leeches,¹⁰ which entered in drinking water

¹ Emile Müller,—milk,—*Gazette Médicale de Strasbourg*, cited in *Annual of the Universal Medical Sciences*, 1891, vol. iv., F p. 13; Poulet, *Foreign Bodies in Surgery*, New York, 1880, vol. ii. p. 5.

² Guyon, *Dictionnaire Encyclopédique des Sciences Médicales*, Paris, 1876, art. "Larynx," p. 707.

³ Stokes, *Medical Times and Gazette*, August 29, 1874; Littlejohn, *British Medical Journal*, 1875, vol. i. p. 161; Peaslee, *New Hampshire Journal of Medicine*, 1852, vol. ii. p. 197; Montague, *Dissertatio de Angina Tonsillare*, etc., Strasbourg, 1823; Wray, *Medical Record*, New York, 1888, vol. xxxiii. p. 215,—fatal cases.

⁴ Justi, *Jahrbuch für Kinderheilkunde*, Leipsic, 1872–3, Bd. vi. S. 283; Gaupp, *Würtemb. Corr.-Bl.*, Bd. xi., 1870, No. 23,—fatal cases.

⁵ Vidal de Cassis, *Elements of Pathology*, t. iii.; Poulet, *op. cit.*, p. 6.

⁶ Freeman, *Practitioner*, August, 1883, p. 119; Ashhurst's *Encyclopædia of Surgery*, New York, 1884, vol. iv. p. 458; Hilton's *Clinical Lectures*, *Guy's Hospital Reports*, 3d ser., vol. xiii. p. 31.

⁷ Parrot, *L'Union Médicale*, 1868, t. ii. p. 167; *Lancet*, London, September, 1873. Cases reported by Behrend and Picqué are cited by Poulet, *op. cit.*, p. 8.

⁸ Vidal de Cassis, *op. cit.*; Poulet, *op. cit.*; Rayland, *Diseases and Injuries of the Larynx and Trachea*, Philadelphia, 1838, p. 198.

⁹ Gautier, *Journal de Médecine et de Chirurgie*, 1785, t. lxiv. p. 249, cited by Poulet, vol. ii. p. 23.

¹⁰ Caesar, *British Medical Journal*, 1888, vol. ii. p. 214; Elias, *Gazette Médicale de l'Orient*, Constantinople, 1879, vol. xxii. p. 61; Ficano, *Revue Mensuelle de Laryngologie*, February 1, 1890; Godet, *Archives de Médecine et de Pharmacie Militaires*, 1887, vol. x. p.

from pools or brooks ; flies,¹ entering while the person was riding rapidly through a cloud of them ; lumbricoids,² which made their way from the stomach to the pharynx and so into the air-passages ; a bronchial gland³ which had become detached and passed through an ulcerated opening into the trachea ; a necrosed inferior turbinated bone⁴ which became detached ; the epiglottis⁵ itself, which became impacted in the larynx while eating ; the larynx of a recently killed goose,⁶ which a child inhaled while blowing through it ; the tracheal ring of a goose,⁷ found in the dissecting-room ; cray-fish-claw ;⁸ dog's tooth ;⁹ puff-darts¹⁰ inhaled while taking a deep inspiration preparatory to blowing ; tracheotomy-tubes¹¹ which became corroded and fell into the trachea ; a hypodermic needle,¹² inspired while being held between the teeth ; a toy velocipede,¹³ inspired while being held in the mouth ; a brass boot-hook¹⁴ held in the mouth ; a Punch and Judy whistle ;¹⁵ large tooth-plates ;¹⁶ large brooch ;¹⁷ shawl-pin,¹⁸ inspired while being held in the mouth ; a pipe-stem,¹⁹ inhaled during epileptic seizure ; an iron

438 ; Karlenski and Winternitz, *Prager Medicinische Wochenschrift*, No. 39, 1890 ; Lacreteille, *Gazette de Santé*, 25 Février, 1828, also *Lancet*, London, 1828, vol. ii. p. 104 ; Massei, *Schmidt's Jahrbücher*, 1876, No. 170, p. 271, cited by Poulet, vol. ii. p. 77 ; Maissurianz, *St. Petersburger Medicinische Wochenschrift*, 1885, N. F., vol. ii. p. 403 (two cases) ; Martin, *Archives de Médecine et de Pharmacie Militaires*, Paris, 1891, vol. xvii. p. 146 ; De la Sota y Lastra, *Revista Médica de Sevilla*, 1883, vol. iii. p. 207 ; Smolitschew, *Vrach. No.* 45, 1884, also *Internationales Centralblatt*, 1886-87, p. 20 ; Vieusse, *Lancet*, London, 1883, vol. ii. p. 788.

¹ Chappell, New York,—reported personally to writer.

² Heusser, *Le Progrès Médical*, 1892, p. 273 ; Cerechez, *Internationales Centralblatt für Laryngologie, Rhinologie, etc.*, No. 189, p. 151.

³ Edwards, *Medico-Chirurgical Transactions*, London, 1854, vol. xxxvii. p. 151.

⁴ Dowse, *British Medical Journal*, 1873, vol. ii. p. 526.

⁵ Ruchle, *Die Kehlkopfkrankheiten*, Berlin, 1861, p. 13 ; Cohen, *Diseases of the Throat and Nasal Passages*, 1879, p. 615.

⁶ Burow, *Casper's Wochenschrift*, *British and Foreign Medico-Chirurgical Review*, January, 1850, p. 260.

⁷ Schrötter, *Monatsschrift für Ohrenheilkunde*, 1882, Bd. x. S. 57.

⁸ Walther, *Graefe et Walther's Journal de Chirurgie*, *American Medical Recorder*, vol. vi. p. 571.

⁹ Geoghegan, *Dublin Medical Press*, January 24, 1849.

¹⁰ Conner, *American Journal of the Medical Sciences*, 1877, vol. lxiv. p. 595 ; Benthall, *Lancet*, London, 1883, vol. i. p. 314 ; Hadden, *London Pathological Society's Transactions*, vol. xxxvi., 1885 ; Lyon, *Journal of Laryngology and Rhinology*, 1888, vol. ii. p. 249 ; Pieniaczek, *Przegląd Lekarski*, 1887, Nos. 47, 48 ; Sykes, *Lancet*, London, 1883, vol. i. p. 272 ; Dawson, *Clinic*, Cincinnati, 1874, vol. vi. pp. 2-4 ; Morse, *Boston Medical and Surgical Journal*, 1878, vol. xcviii. p. 647 ; Wyeth, *New York Medical Journal*, 1884, vol. xl. p. 487 ; Bruce, *Lancet*, London, 1883, vol. i. p. 271.

¹¹ *Vide* p. 506.

¹² Jones, *Lancet*, London, 1880, vol. ii. p. 208.

¹³ Briddon, *New York Medical Journal*, 1890, vol. li. p. 243.

¹⁴ Appleyard, *Medical Press and Circular*, 1887, vol. xciv. p. 96.

¹⁵ Reported by writer.

¹⁶ Blum, *New York Medical Journal*, 1885, vol. xlii. p. 217.

¹⁷ Danaher, *Lancet*, London, 1881, vol. ii. p. 613.

¹⁸ Wharton, *Philadelphia Medical News*, 1889, April 13, p. 404.

¹⁹ Delasiauve, *Gazette Hebdomadaire de Médecine*, Paris, 1856, vol. iii. p. 239.

buckle,¹ inspired while being held in the mouth; a safety-pin,² supposed to have fallen from the mother's dress into the mouth of a child; an amber cigar-holder,³ inhaled while laughing; a toy balloon,⁴ inspired while playing with it in the mouth; a sponge,⁵ which slipped into the trachea from the nostril, into which it was introduced to cleanse the same; the mouth-piece of a trumpet,⁶ inhaled into the left bronchus.

The shape of an object does not preclude its entering the air-passages, and its size is limited only by the capacity of the larynx to admit it. In some instances, however, the dimensions of the foreign body were greater than the dimensions of the laryngeal cavity⁷ when normally opened to its fullest extent.

Schroetter⁸ relates the case of a patient who, while asleep, and during tranquil breathing, inspired into the lower part of the larynx a set of false teeth which in all diameters was greater than the widely-opened larynx, and the patient remained unconscious of the fact until he missed his teeth in the morning.

More than one object may be found in the larynx and trachea at the same time. Weir⁹ removed from the larynx a two-cent piece and a penny; Chappell,¹⁰ four flies; Gross¹¹ reports the case of a child of seven years who expelled spontaneously at different times a piece of sewing-silk and a piece of cedar. Sipe¹² reports a case in which seven pieces of Indian corn were expelled at intervals, after laryngotomy. In lunatics¹³ different foreign bodies have often been found occupying the larynx and trachea at the same time.

MODES OF ENTRANCE.

Foreign bodies may enter the air-passages through the mouth, through the neck or the chest-wall, or through fistulous openings, or from other parts of the body.

1. *Through the Mouth.*—By far the greatest number enter through the fauces during forcible or ill-timed respiratory effort, either while laughing,¹⁴ or from being suddenly surprised or frightened while eating,¹⁵ or startled,

¹ Pemberton, *Lancet*, London, 1884, vol. i. p. 927.

² White, Richmond, Virginia,—reported personally to the writer.

³ Posthuma, *Weekbl. van het Nederl. Tijdschr. voor Geneesk.*, No. 1, 1889.

⁴ Glasgow, *New York Medical Record*, 1891, vol. liv. p. 460.

⁵ Peaslee, *New Hampshire Journal of Medicine*, 1852, vol. ii. p. 197.

⁶ Steavenson, *Lancet*, London, 1874 (American reprint), p. 258.

⁷ Lennox Browne,—tooth-plate,—*Journal of Laryngology and Rhinology*, London, 1891, vol. v. p. 29.

⁸ *Monatsschrift für Ohrenheilkunde*, Bd. x. No. 6, S. 21.

⁹ *New York Medical Journal*, 1890, vol. li. p. 243.

¹⁰ New York,—reported personally to the writer.

¹¹ Gross, *Foreign Bodies in the Air-Passages*, p. 145.

¹² *Ibid.*, p. 298.

¹³ Christian, *L'Union Médicale*, July 5, 1885; *Annales des Maladies de l'Oreille, du Larynx, etc.*, 1885, tom. xi. p. 371.

¹⁴ Bell,—plum-pit,—*American Journal of the Medical Sciences*, 1829, vol. v. p. 518.

¹⁵ Perrin, Poulet, *op. cit.*, vol. ii. p. 81.

as by an unexpected blow on the back,¹ or from being tickled about the neck² when having some substance in the mouth.

Aronssohn³ in his admirable essay reports the case of a child who, being knocked down by a carriage while eating a nut, suddenly inhaled it, which produced immediate symptoms of asphyxia.

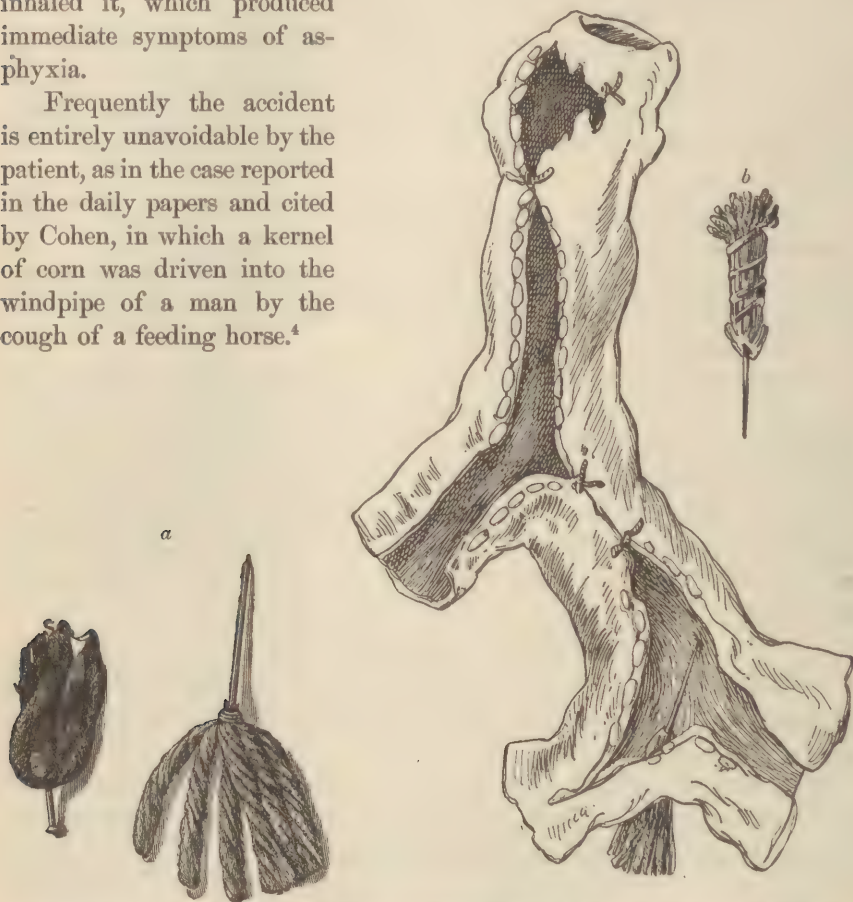
Frequently the accident is entirely unavoidable by the patient, as in the case reported in the daily papers and cited by Cohen, in which a kernel of corn was driven into the windpipe of a man by the cough of a feeding horse.⁴

FIG. 1.

c

b

a



PUFF-DARTS.—a, American pattern (Wyeth); b, English pattern; c, puff-dart lying in the bronchus (Bruce).

Wyeth⁵ reports the case of a boy aged ten years who inhaled into his trachea the dart of a blow-gun. Many other reports of cases similar to this are recorded.⁶ (Fig. 1.)

¹ Schenck,—piece of lead,—Mt. Carmel, Ill.,—reported personally to the writer; Collier,—percussion-cap,—Lancet, London, 1889, vol. i. p. 116.

² Benoit, Poulet, op. cit., p. 18.

³ Thèse de Strasbourg, 1856, Observation 22.

⁴ Chicago Times and Philadelphia Times, December 28, 1879; also Ashhurst's International Encyclopædia of Surgery, vol. v. p. 666.

⁵ New York Medical Journal, 1884, vol. xl. p. 487.

⁶ Loc. cit.

Children amusing themselves with whistles,¹ toys, and other substances often draw them into the air-passages. Young children are especially liable to this accident, from their proclivity to investigate everything through the sense of taste.²

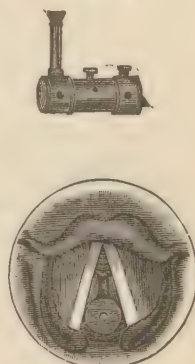
A child aged eight months was brought to my office in a cyanotic condition due to inhaling into the larynx a piece of egg-shell which it had put in its mouth while playing.

Children often fall asleep with objects in their mouths which they inspire into the air-passages. A most interesting case of this kind is reported by Johnston.³ A boy of fourteen fell asleep with a toy locomotive in his mouth, which became lodged in his larynx (Fig. 2).

Adults are also quite liable to accidents of this kind, particularly the inhalation of tooth-plates during sleep.⁴ Foreign bodies are, moreover, frequently inhaled during operations. Thus, in one instance, during the extraction of a tooth the blade of the forceps broke and lodged in the right bronchus.⁵ Teeth on being extracted have slipped from the blades of the forceps and fallen into the air-passages.⁶ Corks carelessly held in the teeth⁷ or inserted between them during anæsthesia have become lodged in the trachea, causing death.⁸ Sponges used about the mouth and air-passages during operations⁹ have also been inspired.

2. *Through the Neck or Chest-Wall.*—Foreign substances entering through the neck or chest-wall are usually flying fragments from explosions, bullets, and other projectiles. This is well illustrated by the oft-quoted and classical case of Lamartinière,¹⁰ where a large headless pin attached to a lash was driven into the trachea through the neck of a boy aged ten years. A case is reported by

FIG. 2.



Toy locomotive in the larynx (Johnston).

¹ Hamilton, Gross, op. cit., p. 157; Watson, Philadelphia Medical News, 1892, p. 190.

² Richardson,—broken arm of a china doll,—Archives of Pediatrics, 1893, vol. x. p. 223; Bannister,—metal plate,—Boston Medical and Surgical Journal, 1847, vol. xxxvi. p. 142; Kocher,—metal tube,—Wiener Klinische Wochenschrift, 1890, No. 7.

³ Archives of Clinical Surgery, December, 1876, vol. i. p. 211.

⁴ Schrötter, loc. cit., S. 21; Linares, Revista de Medicina y Cirugía Prácticas, October 7, 1889; Bryant,—button,—British Medical Journal, 1889, vol. i. p. 1348.

⁵ MacCormac, Lancet, London, 1886, vol. i. p. 7.

⁶ Hertz, Dental Cosmos, 1873, p. 478; Weir, two cases; New York Medical Journal, 1883, vol. xxxviii. p. 404; Houston, Dublin Journal of the Medical and Chemical Sciences, 1834, vol. v. p. 42.

⁷ Rushmore, New York Medical Journal, 1891, vol. liv. p. 85.

⁸ Agnew, Principles and Practice of Surgery, vol. iii. p. 45; Cincinnati Lancet and Medical Observer, 1867; Philadelphia Medical and Surgical Reporter, 1867.

⁹ Cohen, Diseases of the Throat and Air-Passages, 2d ed., p. 572; Mears, Ashhurst's International Encyclopedia of Surgery, vol. v. p. 665,—during excision of tongue; life saved by immediate tracheotomy.

¹⁰ Mémoires de l'Académie Royale de Chirurgie, 1774, tom. v. p. 521.

Tauber, in which a man¹ was shot in the neck, and twelve years afterwards the bullet was removed from the left pyriform sinus. Similar cases are reported by Broussais² and Newman.³ Houston⁴ reports the case of a man twenty years of age who accidentally shot himself in the left side between the fifth and sixth ribs. He died twenty-five years later from chronic pulmonary trouble, and the bullet was found at the end of one of the bronchial tubes.

Portions of ill-constructed tracheotomy-tubes, or tubes not properly cared for and allowed to corrode, may become detached and fall into the trachea. Cohen⁵ has collected fifteen cases of this "inexcusable accident," and five⁶ additional ones are herein cited.

3. *Through Fistulous Openings.*—Foreign substances may pass from the œsophagus into the trachea through fistulous openings, as in the case reported by Paterson,⁷ in which a toy tin cup became impacted in the œsophagus of a child and ulcerated through into the trachea. A similar case is reported by Gerster.⁸

4. *From Other Parts of the Body.*—Substances originating from within the body may pass from one point to another, thereby becoming lodged in the larynx or trachea. Thus, vomited matter⁹ may be drawn into the air-passages through conscious attempts to suppress emesis,¹⁰ or even during a period of unconsciousness from fainting or anæsthesia,¹¹ or during a drunken stupor.¹²

Lumbricoids¹³ have in a number of instances been known to pass from the stomach through the œsophagus and larynx into the trachea, and have sometimes caused death.

Worms developing from larvæ introduced by the bite of a dog in the cheek have found their way into the trachea and caused death.¹⁴

¹ Archives of Laryngology, 1881, vol. ii. p. 62.

² History of Chronic Phlegmasia, English translation, vol. i. p. 305.

³ British Medical Journal, 1884, vol. ii. p. 384.

⁴ American Journal of the Medical Sciences, vol. x., N. S., p. 342.

⁵ Ashhurst's International Encyclopædia of Surgery, vol. v. p. 665.

⁶ Pemberton, Lancet, London, 1884, vol. i. p. 927; Sutherland, Philadelphia Medical News, 1892, vol. ix. p. 243; Sands, Annals of Anatomy and Surgery, 1883, vol. viii. p. 279; Massei, Archivii Italiani di Laringologia, Napoli, 1889, vol. xi. p. 150; Pritchard, Lancet, London, 1872, vol. i. p. 113.

⁷ Edinburgh Medical and Surgical Journal, 1849, vol. lxii. p. 125.

⁸ Annals of Surgery, 1886, vol. iv. p. 174.

⁹ Warren, New York Medical Journal, 1882, vol. xxxv. p. 478; Vidal de Cassis, *Eléments de Pathologie*, tom. iii.

¹⁰ Laennec, *Diseases of the Chest*, 1835, p. 131.

¹¹ Aronsohn, *Thèse de Strasbourg*, 1856; Howse, *British Medical Journal*, 1876, vol. ii. p. 52.

¹² Rayland, *Diseases of the Larynx and Trachea*, Philadelphia, 1838, p. 198; Parrot, *L'Union Médicale*, 1868, vol. ii. p. 167.

¹³ Lepelletier, *Journal Hebdomadaire*, 1831, tom. iv. p. 367; Heusser, loc. cit.; Fürst, *Wiener Medicinische Wochenschrift*, 1879, vol. xxix. pp. 52, 111, 140 (reports twenty-five cases).

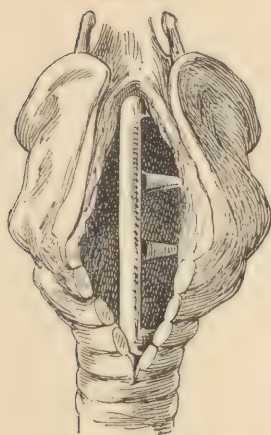
¹⁴ *Froriep's Notizen*, Bd. xl.

FIG. 3.



Piece of boiled beef in the larynx
(Poulet).

FIG. 4.



A buckle in the larynx (Pemberton).

FIG. 6.

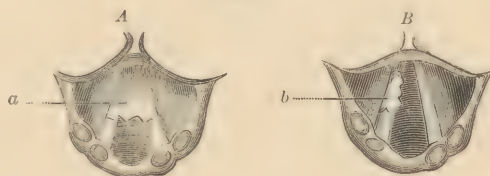
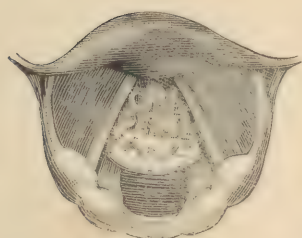
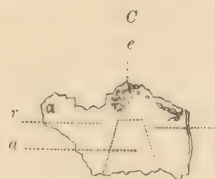


FIG. 5.



Dime in the larynx (Ives).

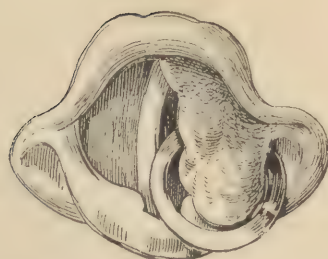


LAMELLA OF BONE IN THE LARYNX (Morell Mackenzie).
—A. The larynx as first seen; *a* is a horizontal lamella of bone, whose outer extremities pass into the ventricles of each side.

B shows the view of the larynx after the bone has been broken and the central portion and that passing into the left ventricle have been removed; *b* is the fractured edge of the fragment of bone remaining in the right ventricle.

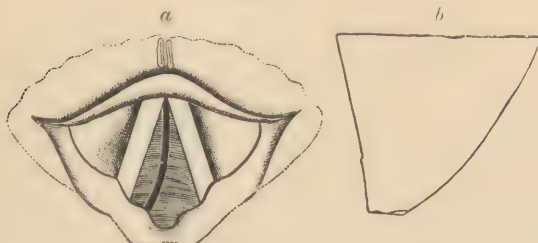
C is the bone put together after removal; *a* corresponds to the portion indicated by the same letter in A; *r* is the part which passed into the right ventricle, *l* the portion which rested in the left ventricle, and *e* the surface of the bone that was hidden by the epiglottis.

FIG. 7.



Brass watch-ring in the larynx
(Lefferts).

FIG. 8.



a, Piece of glass in the larynx; *b*, the same after removed
(Ransom).

Cases are reported by Holden¹ and Coupland² of a necrosed inferior turbinated bone in one case, and of a portion of the base of the skull in the other, becoming detached and falling into the trachea.

In one instance the wing of a thyroid³ became detached by an injury to the neck, and entered the trachea.

Detached bronchial glands⁴ have ulcerated through into the trachea or bronchi, and a necrosed portion of the sternum⁵ penetrated the trachea in the same manner. Edwards⁶ reports the case of a boy in whom a bronchial gland becoming detached passed by an ulcerated opening into one of the bronchi. It was then forced up the trachea during violent coughing and became impacted in the rima glottidis.

Bronchial calculi⁷ have also acted as foreign bodies.

The most interesting case is, perhaps, the one reported by Ruehle,⁸ where the epiglottis itself became impacted in the larynx.

PHYSICAL CONDITIONS ATTENDING THE LODGEMENT OF FOREIGN BODIES.

In order to observe intelligently the effects produced by foreign bodies in the air-passages, it is necessary to note certain conditions which attend their lodgement. These have reference to their location and position, their fixation or mobility, and the physical changes to which they are subject.

1. *Location and Position.*—The location of foreign bodies in the air-passages depends largely upon their size and shape. Large pieces of alimentary substances (Fig. 3), or angular bodies, such as buckles⁹ (Fig. 4) and tooth-plates, are usually arrested in the larynx;¹⁰ sharp penetrating objects, such as pins and needles, are commonly found penetrating the epiglottis,¹¹ the ary-epiglottic folds, the ventricular bands, or the supra-glottic portion of the larynx. Flat bodies, such as coins (Fig. 5), buttons, lamellæ of bone (Fig. 6), and similar substances, are usually found occupying the ventricles of the larynx;¹² although if large and angular they may lie vertically between the cords, as in Figs. 8 and 9. Small, round, and heavy bodies, such as bullets, almost always descend into the trachea.

In some instances foreign bodies may lie partly within the larynx and

¹ Newark, New Jersey,—reported personally to the writer.

² Lancet, London, 1884, vol. i. p. 984.

³ Poulet, op. cit., vol. ii. p. 20.

⁴ Voeleker, British Medical Journal, 1890, vol. ii. p. 1179,—two cases in children.

⁵ Berard, Thésis de Corporibus Extraneis, 1840.

⁶ Medico-Chirurgical Transactions, London, 1854, vol. xxxvii. p. 151.

⁷ Virchow-Hirsch Jahrbücher, 1876; Krieger, op. cit.

⁸ Loc. cit.

⁹ Pemberton, Lancet, London, 1884, vol. i. p. 927.

¹⁰ Frankhauser, Times and Register, May 3, 1890.

¹¹ Martel, Annales des Maladies de l'Oreille, du Larynx, etc., 1881, tom. vii. p. 343.

¹² Krishaber,—coins, four cases,—Annales des Maladies de l'Oreille, du Larynx, etc., 1880, tom. vi. p. 319; Mackenzie,—lamella of bone (Fig. 6),—Diseases of the Throat and Nose, vol. i. p. 417; Ives,—dime,—Archives of Laryngology, 1883, vol. iv. p. 204 (Fig. 5).

partly without. Lefferts¹ reports an interesting case of this kind (Fig. 7), in which a brass watch-ring was, for four years, so embedded as to lie astride the aryteno-epiglottic fold and ventricular band.

Substances may occupy both the larynx and the upper portion of the trachea,² as in the case of live fish and of tooth-plates, which in many instances have become lodged in the sub-glottic portion of the larynx. Small bodies located here are usually those which have been coughed up from the trachea.

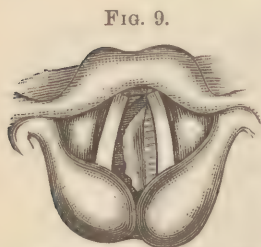


FIG. 9.
Piece of bone lodged vertically in the larynx (F. W. Rockwell).

The positions of foreign bodies are various. Long bodies usually lie vertically and parallel to the long diameter of the larynx, although in some instances they lodge crosswise. Schroetter³ and Blanc⁴ report cases where long slender bones were found lying across the larynx, in one case with one end in each ventricle, in the other case with one end in each pyriform sinus.

2. *Fixation or Mobility.*—Foreign bodies in the larynx or trachea may be fixed or movable. In the larynx they most often become fixed in the ventricles; but if sharp and penetrating they may become impacted at any point. In the trachea they usually become fixed in the lower portion, where they may obstruct both bronchi.⁵ Small bodies often descend into the bronchi,—usually the right one, notwithstanding that the right bronchus is thrown off at a greater angle than the left, into which it would be supposed a foreign body would therefore be more likely to fall (Fig. 10). This is due to the fact that the bronchial septum is on the left of the median line, as first pointed out by Goodall,⁶ of Dublin (Fig. 11). In twenty cases of foreign bodies in the bronchial tubes mentioned by Gross, not in one instance did it occupy the left bronchus. In ninety-four cases collected by the writer it was found fifty-eight times in the right bronchus and thirty-six times in the left. Poulet⁷ believes that in many instances this is due to the functional inequality of the lungs: the right lung having one more lobe than the left, the current of air is stronger, and the substance is consequently drawn into that bronchus.

¹ Medical Record, New York, 1874, vol. ix. p. 641.

² Gautier, *op. cit.*; Bullock, Medical Gazette, London, 1836, vol. xviii. p. 951; Cerechez, Clinica, Bukuresci, 1891, No. 14; Internationales Centralblatt, 1892-3, Bd. ix. S. 151; Perrin, Poulet, *op. cit.*, vol. ii. p. 32; Semon and Plicque, Journal de Médecine et de Chirurgie pratiques, February, 1891.

³ Monatsschrift für Ohrenheilkunde, Bd. x. No. 1.

⁴ Thérapeutique Contemporaine, Paris, 1885, t. v. p. 551.

⁵ De la Count,—bean,—Journal of the American Medical Association, 1887, vol. ix. p. 369; Guest, Medical Practitioner and News, 1891, N. S., vol. xi. p. 357,—piece of gristle; not extracted; death.

⁶ Stokes, Treatise on the Diseases of the Chest, Philadelphia, 1844, p. 239; Gross, Foreign Bodies in the Air-Passages, p. 46.

⁷ *Op. cit.*, vol. ii. p. 27.

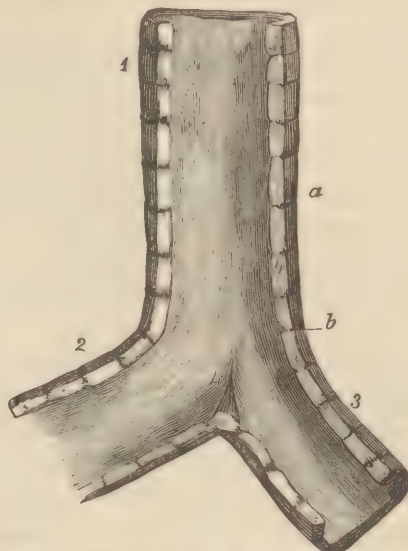
In regard to mobility, it may be said that foreign bodies change their position in the trachea more often than in the larynx. In the latter their position is changed only by a forcible respiratory act or by ulceration, when they are usually expelled. In the trachea they may be movable for

FIG. 10.



Bead in the right bronchus
(Sprengel).

FIG. 11.



BRONCHIAL SEPTUM (Gross).—Trachea and bronchial tubes laid open in front; 1, trachea; 2, right bronchial tube; 3, left bronchial tube; 4, bronchial septum, somewhat magnified to render it more conspicuous.

a considerable time, and play up and down with each respiration. This is particularly the case with round, smooth bodies which are too large to become impacted in a bronchus, as illustrated in a case reported by Thompson,¹ where a pea was movable in the trachea of a boy, and in a case reported by Glasgow,² where a toy balloon moved up and down in the trachea with each respiration.

The relative danger to life of fixed or of movable bodies depends upon their size, shape, and location. There is much less danger attending the change of position of small or long slender bodies than of flat or angular ones, which by a change of position may become impacted crosswise, causing instant suffocation.³

Smooth, round bodies, when movable, are attended with the greatest immediate danger to life. When in the larynx they are quite liable to change their position and so fit into the chink of the glottis as to obstruct⁴ or cause spasm of the larynx⁵ and instant suffocation. When in the trachea

¹ British Medical Journal, 1888, vol. ii. p. 1159.

² Op. cit.

³ Frankhauser, Medical Times and Register, 1890, vol. xx. p. 422,—tooth-plate in larynx three days; died very suddenly from change in position of plate.

⁴ Leyden,—stone in larynx one year,—Internationales Centralblatt, 1889-90, p. 476.

⁵ Hess, Inaugural Dissertation, Greifswald, 1891.

they may be thrown up into the larynx and cause suffocation, or become impacted in a bronchus.¹ The sudden change of position of a foreign body from one bronchus to the other may cause instant suffocation.² Grün³ reports the case of a child three years old in whose left bronchus a pea was lodged for four weeks, causing hepatization of the left lung. Instant suffocation resulted from a change of its position and impaction in the right bronchus.

3. *Physical Changes.*—Mineral substances usually become more or less corroded, according to the nature of the metal. Seeds, peas, beans, grains of corn, corks,⁴ and dried substances, such as dried apple, undergo changes by the absorption of moisture, and swell sometimes to double their former size. All substances tend to become coated with inspissated mucus or lymph,⁵ in the effort of nature to render them innocuous and facilitate their expulsion. Occasionally the coating is of a calcareous nature. Broncholiths of the size of a nutmeg⁶ have been thus formed.

Seeds of various kinds sometimes germinate⁷ in the air-passages, and in some cases they crumble into fragments⁸ and are expelled spontaneously.

The disintegration and expulsion of foreign bodies are, however, of rare occurrence. Even when this occurs, so much disease is often excited as to result in the death of the patient.⁹ Gross¹⁰ says, "We might as well wait for the softening and disintegration of the Rock of Gibraltar by the

¹ De la Count,—two cases,—op. cit.

² Mackey,—plum-stone,—British Medical Journal, 1889, vol. i. p. 657.

³ Lancet, London, 1889, vol. ii. p. 1224.

⁴ Rushmore, op. cit.

⁵ Senert, Mémoires de l'Académie Royale de Chirurgie, Paris, 1768, t. iv. p. 531.

⁶ Bullock, Medical Gazette, London, 1836, vol. xviii. p. 951; "Ephemerides of Natural Curiosities," Gross, op. cit., p. 40.

⁷ D'Arey, Velpeau's Operative Surgery, vol. iii. p. 467 (American edition); De la Count,—bean,—op. cit., p. 370; J. M. Warren, Boston Medical and Surgical Journal, 1848, vol. xxxvii. p. 391; Davidson,—corn,—Western Lancet, May, 1848, also American Journal of the Medical Sciences, N. S., vol. xvi. p. 263; Shackelford,—corn,—Gross, op. cit., p. 39; Dupuytren,—bean,—Leçons Orales, t. iii. p. 589, Paris, 1883; Lebouis, Archives Générales de Médecine, 4ème série, t. xxiv. vol. ii. p. 4; Debout, *ibid.*

⁸ Donatus, Mémoires de l'Académie Royale de Chirurgie, 1768, t. iv. p. 527; Archives Générales de Médecine, 3ème sér., t. vii. p. 369, 1840; Maxwell,—corn,—Gross, op. cit., p. 42; Newman,—confection,—Glasgow Medical Journal, 1891, vol. xxvi. p. 268; Sheppard, Boston Medical and Surgical Journal, vol. xxxiii. p. 95.

⁹ Eldridge, Transactions of the Rhode Island Medical Society, Providence, 1860, vol. i. p. 82; Dawson, Clinic, Cincinnati, 1874, vol. vi. p. 2; Broussais, Bulletin de la Société Anatomique, tom. v. p. 83; Andriessen, Wochenschrift für die Gesamte Heilkunde, No. 48, 1837; Lescure, Mémoires de l'Académie Royale de Chirurgie, Paris, 1774, tom. v. p. 524; Louis, Second Memoir on Bronchotomy, Mémoires de l'Académie Royale de Chirurgie, Paris, 1768, tom. iv. p. 542; Sutton, Chelius's Surgery, by South, vol. iii. p. 112; Pelletan, Clinique Chirurgicale, vol. i. p. 2, 1810; McGaughey, Gross, op. cit., p. 180; Abercrombie, Dr. Cragie, Edinburgh Medical and Surgical Journal, 1834, vol. xlii. p. 105; Chessman, New York Post-Graduate, 1889, vol. iv. p. 227; Otz, Revue Médicale de la Suisse Romande, No. 11, p. 708; Strasser, Journal Médicale Suisse, 1862, p. 377.

¹⁰ Op. cit., p. 41.

waters of the Atlantic and Mediterranean, as for the softening and disintegration of a persimmon-stone and a piece of gristle by the heat and moisture of the air-passages."

SYMPTOMS.

The symptoms that attend the introduction of foreign bodies into the air-passages may be divided into: (1) those that take place immediately at the time of the accident; and (2) those that arise subsequently as the result of the sojourn of the foreign body.

1. *Immediate Symptoms.*—The immediate symptoms are usually violent, owing to the extreme sensitiveness of the fauces and larynx; but in cases of diminished sensibility from disease, and during sleep or from alcoholic or narcotic intoxication, they may be almost or quite absent,¹ and the presence of the foreign body may be manifested only by the irritation and inflammation of the parts² or by its interference with respiration³ in consequence of a change of position.

The active symptoms attending the lodgement of a foreign body in the larynx are pain, incessant spasmodic cough, hoarseness, and aphonia, or obstruction to respiration from laryngeal spasm. Often the patient, during the suffocation which attends the serious obstruction of the passages, becomes excited and alarmed and makes frantic efforts to obtain air.⁴ If the obstruction continues, the patient, livid from lack of air, becomes insensible,⁵ and if relief is not obtained death⁶ speedily ensues. In some instances a cough of a croupy⁷ nature or one resembling whooping-cough⁸ has been the only manifestation of the presence of a foreign body in the larynx.

Much greater irritation is produced by sharp, angular bodies than by round or smooth ones. The active symptoms produced by the latter are due either to mechanical obstruction or to spasm of the larynx excited by the foreign body. During the violence of the symptoms emphysema⁹ of the neck and upper portion of the chest may take place from laceration or rupture of the trachea or some portion of the air-passages by the foreign

¹ Kohler, *Berliner Klinische Wochenschrift*, No. 44, 1888; Christina, *L'Union Médicale*, July 5, 1885.

² Danaher,—brooch,—*Lancet*, London, 1881, vol. ii. p. 613; Koch, *Annales des Maladies de l'Oreille, du Larynx, etc.*, 1885, tom. xi. p. 340.

³ Grün,—pea,—*Lancet*, London, 1889, vol. ii. p. 1224.

⁴ The most graphic description of the symptoms attending this accident is, perhaps, given by Gross, *op. cit.*, p. 71.

⁵ Groom,—bread,—*Lancet*, London, 1880, vol. ii. p. 576.

⁶ Tyler, *New York Medical Record*, 1891, vol. xxxix. p. 709.

⁷ Pick,—leaf-shaped ear-ring in left ventricle,—*Lancet*, London, 1889, vol. i. p. 219.

⁸ Green,—orange-seed in trachea,—*International Journal of Surgery*, 1890, vol. iv. p. 162.

⁹ Pate, *L'Union Médicale et Scientifique du Nord-Est*, 1888, No. 5; Krieger, *Inaug. Dissert.*, Berlin, 1884.

body or by the violent expiratory efforts during coughing.¹ In some cases laceration may take place on the extraction of the foreign body.²

Pointed foreign bodies may penetrate important blood-vessels, causing hemorrhage. Witte³ reports a case where a dart, inhaled with its point upward, was driven by coughing through the thyroid cartilage and wounded the carotid artery, causing death.

2. *Subsequent Symptoms.*—If the patient survives the accident, the active symptoms subside in a short time, and more or less tolerance of the foreign body is usually shown until inflammatory symptoms supervene. This is particularly the case when the foreign body is lodged crosswise in the ventricles of the larynx⁴ or is a smooth body in the trachea.

The secondary symptoms of a retained foreign body in the larynx are more or less congestion and œdema⁵ and continued hoarseness or aphonia.⁶ Aphonia may, however, be present when the foreign body is lodged in the trachea.⁷

Alternating attacks of suffocation⁸ are symptomatic of a movable foreign body in the trachea. These attacks may be due to spasm of the larynx from the impaction of a foreign body against the glottis, or from the temporary obstruction of a bronchus; whereas continuous dyspnoea may be due to an impacted foreign body in either the trachea or a bronchus. Fœtor⁹ of the breath, from decomposition, and purulent expectoration, are often present in cases of foreign bodies impacted in the trachea or bronchi. When a bronchus is obstructed, emphysema¹⁰ of the lung often results from inability to expel the confined air, or in consequence of violent coughing, or from laceration of some portion of the air-passages by the foreign body.

¹ Lefferts,—portion of jet ear-ring in trachea.—New York Medical Record, 1882, vol. xxii. p. 599; McLean, *ibid.*, 1884, vol. xxvi. p. 282.

² Weir, *op. cit.*, p. 1.

³ Archiv für Klinische Chirurgie, 1877, S. 193.

⁴ Ives,—lamella of bone,—Archives of Laryngology, 1883, vol. iv. p. 205; Grazi, Bollettino delle Malattie dell' Orecchio, 1884, No. 4, 2 m. p. 503.

⁵ Butlin,—dress-hook,—Lancet, London, 1871, vol. ii. p. 468; Abbe, New York Medical Journal, 1890, vol. li. p. 243; Hodgkinson,—piece of corn-cob,—Lancet, London, 1885, vol. ii. p. 155; Ziemssen, Cyclopædia, vol. vii. p. 801; A. H. Smith, New York Medical Journal, 1879, vol. xxix. p. 44.

⁶ Thompson,—cockle-burr,—Journal of the American Medical Association, 1885, vol. ix. p. 432; Sanderson and Hulke,—sixpence,—Medico-Chirurgical Transactions, London, 1865, vol. xiii. p. 202; French,—bone,—Archives of Laryngology, 1881, vol. ii. p. 59; Ransom,—piece of glass,—New York Medical Record, 1891, vol. xxxix. p. 478.

⁷ Rockwell,—lamella of bone,—Annals of Anatomy and Surgery, 1881, vol. iii. p. 72.

⁸ Green,—orange-seed,—International Journal of Surgery, 1891, vol. iv. p. 162; Clark,—bean,—simulated convulsions,—Glasgow Medical Journal, 1888, vol. xxx. p. 401; also, Medical and Surgical Reporter, 1889, vol. lx. p. 83.

⁹ Elliott,—peanut-shell in right bronchus,—Boston Medical and Surgical Journal, 1889, vol. cxx. p. 607.

¹⁰ Pate,—pebble in trachea,—L'Union Médicale et Scientifique du Nord-Est, 1888, tom. xii. p. 101; Krieger, Inaugural Dissertation, Berlin, 1884; Lescure, Mémoires de l'Académie Royale de Chirurgie, Paris, 1774, t. v. p. 349.

In some cases a localized tuberculosis¹ may occur. Pulmonary hemorrhage may be the evidence of a foreign substance in a bronchus which has perhaps entered without the patient's knowledge, exciting all the symptoms of phthisis. A case is reported by Bosworth² in which the hemorrhage had been of frequent occurrence for about a year; this immediately subsided after the spontaneous expulsion of a calcareous substance.

Sooner or later there is usually more or less inflammatory disturbance,³ with symptoms of obscure bronchial and pulmonary disease, such as bronchitis,⁴ pneumonia,⁵ pleurisy,⁶ phthisis,⁷ pulmonary abscess,⁸ and gangrene.⁹ These symptoms frequently subside on the extraction or expulsion of the foreign body, although at times they terminate in death even after this has taken place. Of twenty-nine cases collected by Gross¹⁰ which were fatal without operation, eight died after a period varying from three days to four years after the expulsion of the foreign body.

Cases are reported of pericardial, mediastinal,¹¹ and hepatic abscesses;¹² the latter resulting from the extension of the inflammation from the cavity of the chest through the diaphragm to the liver.

The liability of heart-clot to result from obstructed respiration has been pointed out by Ingals.¹³ Disturbance of the circulation by a foreign body has caused epilepsy and cerebral symptoms.¹⁴

¹ Pitts.—piece of nut in trachea,—British Medical Journal, 1884, vol. ii. p. 1193.

² Diseases of the Nose and Throat, 1892, vol. ii. p. 701.

³ Chessman,—nail in bronchus one year,—New York Post-Graduate, April, 1889; Weiszbarth,—bean in bronchus,—Pester Med.-Chir. Presse, Budapest, 1888, Bd. xxiv. S. 224.

⁴ Wharton, Medical News, 1889, vol. liv. p. 404; a large brass shawl-pin caused, in one case, large fibrinous pseudo-membranes; De la Count,—tack,—Journal of the American Medical Association, 1887, vol. ix. p. 369; Rosenbach,—bone in trachea three years; putrid bronchitis,—Virchow-Hirsch Jahrbücher, 1874.

⁵ Krieger, Inaugural Dissertation, Berlin, 1884, S. 7; De Angelis, Gl' Incurabili, 1 e 15 Ottobre, 1891; Elliott, op. cit.; De la Count,—sixpenny nail in trachea,—op. cit.

⁶ Volland, Virchow-Hirsch Jahrbücher, 1878, Bd. ii. S. 144.

⁷ Epler, New York Medical Record, 1891, vol. xxxix. p. 729; Kehler, Berliner Klinische Wochenschrift, No. 44, 1888; Laborde, Gazette Médicale, 1868, p. 705; Poulet, op. cit., p. 62; Jean, Bulletin de la Société Anatomique, 1876, p. 307; De la Count, op. cit.

⁸ Bruce,—puff-dart,—Lancet, London, 1883, vol. i. p. 815; Sanders,—a patient coughed for five minutes, no symptoms for a year, when during a sudden onset of suffocation a pit was expelled with a large amount of pus; death three days later,—Archiv für Klinische Medicin, 1874, Bd. xvi.

⁹ Fogg,—prune-stone,—Boston Medical and Surgical Journal, 1852, vol. xlv. p. 501; Lucas,—tracheotomy-tube,—Medico-Chirurgical Transactions, 1877, vol. lx. p. 99, 2d ser.; Broussais, Bulletin de la Société Anatomique, tom. v. p. 83.

¹⁰ Op. cit., pp. 49, 176.

¹¹ Lancet, London, 1849, vol. ii. p. 480.

¹² Mayo's Outlines of Pathology, London, 1836, p. 506.

¹³ Independent Practitioner, 1882, vol. iii. p. 364.

¹⁴ Sanders,—grain-head inhaled into trachea,—Archiv für Klinische Medicin, 1875, Bd. xvii.

Hager¹ reports a case in which death was caused by a persistent irritation of the vagus from a fish-bone embedded in the epiglottis.

DIAGNOSIS.

1. *History of the Case.*—The history of the accident and the character of the objective symptoms are of great importance in indicating the nature of the foreign body. Sometimes no definite history can be obtained: a child playing with some article or substance may swallow it unconsciously, or may inspire it during a sudden fright, giving rise only to symptoms of croup.²

In adults a foreign body may be inspired during an epileptic seizure³ or at the moment of receiving a blow or injury,⁴ in which case the resulting dyspnoea may be attributed to the effects of the attack or accident or to foul play.⁵

A foreign body may drop into the larynx during sleep⁶ or during temporary unconsciousness, when no history of the accident can be obtained.

In other cases the larynx may be so completely blocked and death be so instantaneous that it may be attributed to disease of the heart, to apoplexy, or to epilepsy, and the real cause remain unsuspected.

2. *Physical Examination.*—The principal methods of obtaining a knowledge of the condition of the patient through physical examination are simple inspection, laryngoscopic examination, exploration with the finger, and auscultation.

(a) By simple inspection. By placing the patient in a strong light and firmly depressing the tongue, foreign bodies occupying the upper parts of the larynx or lying partly in the larynx and partly in the pharynx can frequently be seen. When this fails, other methods should be resorted to.

(b) By laryngoscopic examination. In every case in which a foreign body is suspected to be in the larynx, a laryngoscopic⁷ examination should be made; and in some instances its use has revealed the lodgement of such bodies when their presence had not been suspected.⁸

¹ Schmidt's Jahrbücher, Bd. xiv.

² Harrison, Canadian Practitioner, Toronto, 1886, vol. ix. p. 99; Danaher, op. cit.; Labbé, Congrès Français de Chirurgie, Mars, 1888; Annales des Maladies de l'Oreille, du Larynx, etc., 1889, t. xv. p. 25,—metal star in larynx.

³ Da Costa,—piece of apple,—Boston Medical and Surgical Journal, 1888, vol. cxix. p. 628; Delasiauve,—piece of bowl of pipe,—Poulet, op. cit., vol. ii. p. 17.

⁴ Aronsohn, op. cit.

⁵ Brownell,—bean in trachea,—Boston Medical and Surgical Journal, 1848, vol. xxxviii. p. 333, cited by Gross, op. cit., p. 43.

⁶ Svanson,—false teeth,—Hygiea, Mars, 1884, p. 172; also Internationales Centralblatt für Laryngologie, 1884-85, p. 362; Major,—tooth-plate,—Archives of Laryngology, 1882, vol. iii. p. 350.

⁷ British Medical Journal, 1874, vol. i. p. 429.

⁸ Oertel,—tooth-plate with three teeth in the larynx three months,—only bronchitis suspected; removal with forceps; Virchow-Hirsch Jahrbücher, 1867.

During the period of spasm and irritation, however, examination is very difficult, owing to the unmanageable condition of the patient. In children it is well-nigh impossible. Cocaine and chloroform are, however, of great assistance in controlling the spasm. Schroetter¹ is of the opinion that laryngoscopic examination is possible in every case where absolute strangulation is not imminent. In twenty cases reported by him he succeeded in every instance in making a thorough laryngoscopic examination.

Foreign bodies in the trachea can frequently be seen with the laryngoscope.² In the case already referred to by Major³ he distinctly saw the tooth-plate at the bifurcation; and in the case of a Punch and Judy whistle⁴ that had been inhaled, the writer had no difficulty in seeing the foreign body situated in the lower part of the trachea. There have been reported many other cases in which a foreign body in the trachea has been discovered with the laryngoscope.

(c) By exploration with the finger. Foreign bodies in the larynx can sometimes be detected with the finger when a laryngoscopic examination is impossible,⁵ or where they are so embedded that they cannot be seen.⁶

(d) By auscultation. It is often difficult to discover the location of foreign bodies when in the trachea or bronchi, although they can usually be detected by auscultation. A whistling sound⁷ may be heard in case of whistles, or if movable in the bronchi their situation is often indicated by the "flapping noise,"⁸ or Zwinger's "chattering bruit,"⁹ which is frequently heard. At times the oscillation of a foreign body up and down the trachea during each respiration can be felt by palpation,¹⁰ as was first observed by Allan Burns.¹¹ The patient himself is sometimes conscious of the oscillation when it cannot be perceived by the surgeon.¹²

When the foreign body is fixed in the trachea, diminished respiration is uniform throughout the chest; whereas if it is located in one of the bronchi the diminution is manifest only over the region of the lung supplied by it.

¹ Monatschrift für Ohrenheilkunde, 1876, Bd. x., No. 7, p. 105.

² Koch, Annales des Maladies de l'Oreille, du Larynx, etc., 1885, vol. xi. p. 203; Montez, La Semaine Médicale, 27 Mai, 1891.

³ Loc. cit.

⁴ Loc. cit.

⁵ Parker,—safety-pin in larynx of an infant,—New York Medical Record, 1892, vol. xlii. p. 214.

⁶ Koch,—pin embedded in left crico-arytenoid body,—Annales des Maladies de l'Oreille, du Larynx, etc., 1885, tom. xi. p. 340.

⁷ Bryant, British Medical Journal, 1894, vol. i. p. 1348; also author's case, *supra*.

⁸ Mason, Medical and Surgical Reporter, Philadelphia, 1876, vol. xxxv. p. 515.

⁹ Poulet, op. cit., p. 69.

¹⁰ Dorr, Pacific Medical and Surgical Journal, 1882, p. 53; Stroem,—cherry-stone,—Medical Society of Christiania, September 12, 1888; Ekel,—fruit-stone,—Pester Medicinisch-Chirurgische Presse, Budapest, No. 30, 1890.

¹¹ Surgical Anatomy of the Head and Neck, 1823, p. 413; also Rust's Magazine, vol. xxi. p. 568.

¹² Bentlif,—prune-stone,—British Medical Journal, 1892, vol. i. p. 1359; Wilson,—tin whistle,—Glasgow Medical Journal, 1892, vol. xxxviii. p. 24.

When the foreign body is located in the left primary bronchus, there is obstruction to respiration through the entire left lung; but when it is located in the right bronchus, the diminution in respiration is usually manifested only over the lower lobe, for the reason that the substance is most often lodged below the first division of the right bronchus.¹

Movable foreign bodies in the bronchi are manifest upon auscultation by the change in the area of diminished respiration.

3. *Differential Diagnosis*.—The dyspnœa caused by the impaction of a foreign body in the larynx or trachea should be differentiated from that caused by the presence of one in the pharynx or œsophagus, by exploration of the latter organs; the sudden unconsciousness from the complete obstruction of the air-passages, from that of apoplexy or epilepsy; the spasmodic character of the cough often present when a foreign body is lodged in the larynx, from that of whooping-cough;² the stridulous breathing, from that of croup;³ the hectic symptoms often caused by a foreign body in the larynx or lung, from those of phthisis; the fetor of the breath sometimes present when a foreign body is lodged in the trachea or bronchi, from that of fetid bronchitis;⁴ and the increased *effort* in respiration due to a foreign body in the air-passages, from the increased *frequency* in disease.

PROGNOSIS.

The accident of a foreign body becoming lodged in the air-passages is always of a serious nature. Either death takes place at once from suffocation,⁵ or serious inflammatory disturbances may arise that may lead to a fatal result.

By a comparative study of the results obtained by different methods of dealing with foreign bodies in the air-passages we have to determine the degree of success of different methods of treatment.

In an analysis of seven hundred and sixty-two cases of foreign bodies in the air-passages, collected by the writer, in three hundred and twelve the substance was located in the larynx, and in four hundred and fifty in the trachea.

Of the three hundred and twelve cases in which the foreign body was located in the larynx it was removed by an incision through the neck in one hundred and twenty-four cases: of these, twenty-five by laryngotomy, all recoveries; eighty-one by tracheotomy, with sixty-five recoveries; ten by laryngo-tracheotomy, six by thyrotomy, and one by external incision the nature of which was not specified, all recoveries; one by pharyn-

¹ Cohen, Ashhurst's International Encyclopædia of Surgery, vol. v. p. 671.

² Green, loc. cit.

³ Danaher, loc. cit.

⁴ Elliott, loc. cit.

⁵ Heusser, Correspondenz-Blatt für Schweizer Aerzte, Basel, 1892, Bd. xxii. p. 443.—lumbroids; Blum,—tooth-plate,—New York Medical Journal, 1885, vol. xlii. p. 217; Guest, American Practitioner and News, Louisville, 1891, N. S., vol. xi. p. 357. Numerous examples of this accident are reported in medical literature.

gotomy, in which the patient died. In the other one hundred and eighty-eight cases no operation was attempted in thirty-one, and only three of these patients recovered; in forty the foreign body was expelled spontaneously, with thirty-eight recoveries; in one hundred and one it was removed by forceps through the mouth, all recoveries. Of the other sixteen cases, three were removed by inversion of the patient, two by the use of hooks, two by the fingers, six by emesis, the other three by the use of the snare, sponge probang, and turpentine, respectively, all recoveries. Thus we have of the three hundred and twelve cases two hundred and sixty-five recoveries (84.9 per cent.) and forty-seven deaths.

Of the four hundred and fifty cases in which the foreign body was lodged in the trachea, it was removed by incision through the neck in two hundred and thirty-nine, with two hundred and one recoveries. Of these, two hundred and twenty-two were by tracheotomy, nine by laryngo tracheotomy, eight of which were recoveries, seven by laryngotomy, and one by thyrotomy, all recoveries. Of the remaining two hundred and eleven cases, in fifty-eight no operation was performed, and there were but two recoveries; in one hundred and twenty-four the foreign body was expelled spontaneously, with one hundred and twelve recoveries; in fourteen removals by forceps, nine by inversion, two by emesis, one by the use of iodine, one by a blow on the back, all were recoveries. In two cases oil was used, one patient recovering. Thus, of four hundred and fifty cases of foreign bodies in the trachea there were three hundred and forty-three recoveries (77 per cent.) and one hundred and seven deaths.

It is to be observed that of the seven hundred and sixty-two cases of foreign bodies lodged in the air-passages there were three hundred and sixty-three in which they were removed by an incision through the neck, with three hundred and eight recoveries (84.8 per cent.) and fifty-five deaths; while of the three hundred and ninety-nine in which bronchotomy was not resorted to, there were three hundred recoveries (75.2 per cent.) and ninety-nine deaths. These statistics are quite in harmony with those of Durham and Gross. Durham¹ reports seven hundred and six cases of foreign bodies in the air-passages. Of four hundred and thirty-five on which operations were performed, there were three hundred and twenty-eight recoveries (75.4 per cent.). Of the two hundred and seventy-one cases in which no operation was performed, one hundred and fifty-six resulted in recovery (57.5 per cent.).

Gross² reports one hundred and eighty-three cases. In ninety-eight cases the air-passages were opened, with eighty-three recoveries (84.7 per cent.) and fifteen deaths. In eighty-five cases in which no operation was performed, there were fifty-six recoveries (65.9 per cent.) and twenty-nine deaths.

¹ Holmes's System of Surgery, vol. i. p. 709.

² Foreign Bodies in the Air-Passages, p. 308 *et seq.*

Weist reports one thousand cases, collected mainly from private sources. Of these three hundred and thirty-eight were operated on, with two hundred and forty-five recoveries (72.5 per cent.) and ninety-three deaths. In five hundred and ninety-nine cases no operation was performed, with four hundred and sixty recoveries (76.8 per cent.) and one hundred and thirty-nine deaths.

Combining the statistics of Durham, Gross, Weist,¹ and the writer, we have two thousand six hundred and fifty-one cases, in twelve hundred and thirty-four of which there were operations, with nine hundred and sixty-four recoveries (78 per cent.). In fourteen hundred and seventeen cases no operations were performed, with ten hundred and thirty-five recoveries (73 per cent.).

It will be seen that all the statistics except Weist's support the consensus of opinion of surgeons, that no foreign body should be allowed to remain for any length of time in the air-passages without the operation of bronchotomy; but this should be done in urgent cases only, when all other means of extraction have failed.

Statistics, however, are misleading if we do not take into consideration the various conditions affecting them. Thus, Weist's statistics are founded almost entirely on cases reported to him privately, which the physicians evidently did not consider of sufficient importance to report in medical literature, and, moreover, the foreign bodies in more than one-half of the cases were seeds of various kinds, such as grains of corn, watermelon-seeds, beans, and grains of coffee, substances that ordinarily do the least harm in the air-passages and are the most likely to be expelled spontaneously. In the statistics of death without operation, it should also be remembered that in many cases death occurred before any operation could be performed, and therefore could not be attributed to delay.

The operation is so comparatively free from danger that Weist is not justified in the conclusion that "when the trachea or bronchus contains a foreign body the patient will be more likely to recover if trusted to the chance of spontaneous expulsion than he will be if subjected to operation."²

The necessity of external incision cannot, we think, be better illustrated than by the fact that of eighty cases of tracheotomy reported by Bourdillat³ in twenty-eight the foreign body was expelled spontaneously. Durham⁴ reports ninety-one cases in which the foreign body was expelled after opening the trachea: in sixty-two of these expulsion took place through the tracheal opening, and in thirty-nine it was immediate, showing that the foreign body was movable in the trachea and could not pass the glottis.

The frequency with which death results as a remote effect of a foreign body lodged in the air-passages, even though the substance may have been

¹ Transactions of the American Surgical Association, 1881-83, vol. i. p. 117.

² *Ibid.*, vol. i. p. 124.

³ *Gazette Médicale de Paris*, 1868, tom. xxiii. p. 136.

⁴ *Holmes's System of Surgery*, vol. i. p. 714.

expelled or removed, has been pointed out in discussing the remote symptoms. In many instances, however, the foreign body may be retained for a considerable period without detriment to the patient and finally expelled either through the opening by which it entered or by some artificial passage.

SPONTANEOUS EXPULSION AND MIGRATION.

A foreign body is usually expelled through the opening by which it enters. In one hundred and sixty-three cases in which spontaneous expulsion took place it was through the mouth in all but three. Instances in which a foreign substance has entered through one channel and been expelled through another after being retained for a time are recorded. Hiero Stoessel¹ reports an interesting case in which the paper obturator of a gun penetrated a man's larynx and was immediately expelled by coughing. Fauvel² reports a case in which a bullet lodged in the bones of the face was expelled spontaneously from the left pyriform sinus ten years afterwards.

In many instances foreign bodies in the larynx have penetrated the tissues of the neck and been extracted externally,³ and substances like heads of grain have entered through the larynx and trachea and been expelled through an abscess in the chest-wall.⁴ In 1812 Desgranges⁵ published sixteen cases in which this was supposed to have taken place. Bourdillat⁶ found in one hundred and sixty-seven cases seven instances in which this occurred. Opitz⁷ reports thirteen cases of grain-heads inhaled into the trachea; of these, four were expelled spontaneously through the mouth, and nine through thoracic abscesses. Hévin⁸ and Poulet,⁹ however, seem to believe that all the heads of grain and similar substances which have been reported as passing through the thoracic wall came from the œsophagus, and that there are no evidences that they came from the air-passages.

Gross, on the contrary, shows conclusively that such bodies do sometimes migrate from the air-passages, and cites twelve cases reported by Stanski¹⁰ and one by Avery¹¹ in which acute symptoms due to the presence of foreign bodies in the bronchi were manifested.

In a case reported by Marrow¹² a piece of hay was inhaled. Forty-two weeks afterwards it was expelled through an abscess between the tenth and twelfth ribs.

¹ *Annales des Maladies de l'Oreille, du Larynx, etc.*, 1888, t. xiv. p. 283.

² *Revue Mensuelle de Laryngologie, etc.*, 1881, tom. ii. p. 395.

³ Coomes,—pin,—*Medical and Surgical Reporter*, Philadelphia, 1884, vol. i. p. 363; Wharton,—pin penetrated the thyroid cartilage,—*Archives of Pediatrics*, 1884, vol. i. p. 53.

⁴ Bonet, *Med. Sept.*, lib. iii., cited by Poulet, vol. ii. p. 55.

⁵ *Journal Général de Médecine*, tom. xlv. p. 180.

⁶ *Op. cit.*, p. 135.

⁷ Schmidt's *Jahrbücher*, 1858.

⁸ *Mémoires de l'Académie Royale de Chirurgie*, Paris, 1743, tom. i.

⁹ Poulet, *op. cit.*, vol. ii. p. 54.

¹⁰ *Gazette Médicale de Paris*, Juillet, 1837; *British and Foreign Medical Review*, vol. ii. p. 251.

¹¹ Gross on *Foreign Bodies in the Air-Passages*, p. 57.

¹² *Lancet*, London, December, 1862, vol. ii. p. 348.

Cases are reported in which objects have entered through the chest-walls and been expelled through the bronchi,¹ and also where they have entered the chest through an opening, as a gunshot wound, and been expelled through another passage made by the foreign body itself.²

The length of time foreign bodies may be tolerated before spontaneous expulsion takes place is exceedingly variable. Of Durham's one hundred and twenty-four cases, five were expelled in twenty-four hours, eleven in from one to eight days, sixteen in from eight to thirty days, sixty-four in from thirty days to a year, and twenty-eight in from one year to seventeen years.

In many instances foreign bodies have been tolerated for quite a long time without producing serious disturbance to the patient, as illustrated by the following cases : a stone³ and a safety-pin⁴ each remained in the larynx of a child one year, a bone⁵ in the larynx of a child fourteen months, a brass ring⁶ in the larynx of a child four years, a trunk-nail⁷ in the trachea of a child three years, a lead-pencil⁸ in the bronchus of a child six years, a barleycorn⁹ in the bronchus of a girl seven years, a beechmast¹⁰ in the trachea of a girl nine and a half years, the mouth-piece¹¹ of a cigar-holder in the trachea of a man eleven and a half years, a pin¹² in the larynx thirty-eight years, and a piece of bone¹³ in the bronchi for sixty years.

TREATMENT.

The treatment of foreign bodies in the air-passages may be considered with reference to : (1) expulsion through the natural passages ; (2) extraction through the natural passages ; (3) extraction or expulsion through artificial channels.

1. *Expulsion through the Natural Passages.*—Few accidents require such prompt action on the part of the surgeon as the lodgement of foreign bodies in the air-passages. When suffocation is not imminent, the gravity of the situation can be determined only after the acute manifestations, as choking, spasm, etc., have subsided. No special treatment or instrumental manipulation is required for the removal of fluid foreign bodies. The

¹ Louis's *Memoirs on Bronchotomy*, *Mémoires de l'Académie Royale de Chirurgie*, 1768, tom. iv. p. 528.

² *Ibid.*, p. 529; Gross, *op. cit.*, p. 58.

³ Leyden, *La Semaine Médicale*, April, 1889.

⁴ Daniel's *Texas Medical Journal*, 1890, vol. iv. p. 112.

⁵ Dailey, *Omaha Clinic*, April, 1889.

⁶ Lefferts, *New York Medical Record*, 1874, vol. ix. p. 641.

⁷ Gross, *op. cit.*, p. 169.

⁸ Gridley, *American Medical Recorder*, vol. xiii. p. 473.

⁹ Krieger, *Inaug. Dissert.*, June, 1884; *Hufeland's Journal*, 1883.

¹⁰ Gross, *op. cit.*, p. 172.

¹¹ Krieger, *op. cit.*

¹² Ravenel, *Medical News*, Philadelphia, 1891, vol. lviii. p. 325.

¹³ Bartlett, *Lee's New York Journal of Medicine and the Collateral Sciences*, vol. vi. p. 23, cited by Gross, *op. cit.*, p. 172.

head should be placed in a pendent position and artificial respiration induced until they are expelled and normal respiration re-established. In cases demanding it, resort may be had to Fell's¹ method of forced artificial respiration with a bellows, the nozzle being inserted in the trachea.

Sternutatories,² emetics, and tickling the throat with a feather to provoke coughing have been employed from the earliest times, especially by the laity, for the expulsion of solid foreign bodies from the air-passages.

Sternutatories are sometimes of service. Pettit³ caused in this manner the expulsion of a tooth which had been lodged in the right bronchus for eight months.

Coughing is almost always induced by the foreign body itself, and its artificial production need rarely be resorted to by the surgeon. Emetics are not only of doubtful benefit, but are often positively injurious, owing to the compression of the larynx during the act of vomiting, which may force the foreign body more deeply into the tissues.

Treatment by inversion aided by percussion and succussion as a method of expulsion was first successfully employed for the removal of a coin from the trachea in 1768, and reported to the Royal Historical Society by Sir Christopher Wren.⁴ This method was not brought prominently into notice until 1843, when Sir Benjamin Brodie⁵ reported the celebrated case of Brunel. Cases have since been reported by Lenoir,⁶ Duncan,⁷ Resièyes,⁸ Hanford,⁹ Richard Jelley,¹⁰ Krieger,¹¹ and Arnold.¹²

This method is available only in cases of coins, bullets, and such weighty substances as would be acted upon by the force of gravity. Of the seven hundred and sixty-two cases collected by the writer, the foreign body was expelled in this manner from the larynx in three cases only, and from the trachea in nine cases; six were coins, two were bullets, and in the four remaining cases the foreign bodies were a thimble, a brass staple, a piece of lead, and a stone. In no instance have unsuccessful attempts¹³ proved fatal, for any distressing symptoms are at once relieved, as in Brunel's case, by the erection of the person.

I quite agree with Cohen¹⁴ that the danger of impaction at the chink

¹ Buffalo Medical and Surgical Journal, 1887-88, vol. xxvii. p. 145.

² Hagendorn and Reidlins, Louis's Second Memoir on Bronchotomy, Mémoires de l'Académie Royale de Chirurgie, 1768, tom. iv. p. 523.

³ L'Union Médicale, Mars 13, 1886.

⁴ Birch, History of the Royal Society, vol. iii. p. 381.

⁵ Transactions of the London Medico-Chirurgical Society, vol. xxvi. p. 286.

⁶ Journal de Malgaigne, 1845, tom. iii. p. 55.

⁷ J. M. North, Edinburgh, 1844-45, vol. ii. p. 220; also Lancet, London, 1845.

⁸ Poulet, op. cit., p. 73.

⁹ Holmes's Principles of Surgery, vol. ii. p. 363.

¹⁰ Lancet, London, 1882, vol. i. p. 465.

¹¹ Inaugural Dissertation, June, 1884.

¹² Annals of Anatomy and Surgery, 1886, vol. vi. p. 615.

¹³ Gross,—seven cases,—op. cit., p. 205.

¹⁴ Ashhurst's International Encyclopædia of Surgery, vol. v. p. 672.

of the glottis in inversion is greatly exaggerated by nearly all writers on the subject. Weiss¹ goes so far as to say that in no case should the attempt at expulsion by inversion be resorted to without previously performing tracheotomy.

The best means of practising inversion, particularly in adults, is the one ingeniously devised by Padley,² of Swansea, and described by him as follows: "A strong bench having been fixed with the legs of one end on a couch and the other on the floor, the patient was made to sit on the upper part of it, with his knees flexed over the end. He was then directed to lie back upon the inclined plane thus formed, and, having done so, instantly raised himself up with the sixpence in his mouth. The supine position probably favored the exit of the coin, and the readiness with which by his own effort—the knees acting as a fulcrum—he gained the upright position, would have saved him from the danger of spasm in the event of its non-expulsion."

During inversion the patient should inspire deeply, and, as Dr. Johnson³ suggests, avoid speaking, which brings the vocal cords together and prevents exit of the foreign body. The expulsion is also facilitated by succussion, or a forcible slap or blow on the chest over the point at which the foreign body is believed to be lodged, during the time the body is suspended.

Laryngeal spasm is best relieved by chloroform.⁴ In some cases cocaine may be of advantage, or the temporary introduction of an O'Dwyer's tube may be advisable, as in the following case:⁵

A child three years old with a piece of nut-shell in the larynx was intubated to relieve suffocation. The shell became lodged in the tube and was withdrawn with it.

In some instances the employment of chemical agents to cause the disintegration of the foreign body has had some apparent success. The laryngeal spasm caused by a bean in the larynx was held in complete abeyance in one case by the occasional swallowing of olive oil, and the bean was finally disintegrated and expelled;⁶ a fish-vertebra in the trachea was in another case loosened and expelled by the inhalation of the vapor of iodine.⁷ Leeches in the larynx have been killed by swallowing turpentine,⁸ and by the direct application of chloride of sodium.⁹

2. *Extraction through the Natural Passages.*—Extraction through the natural passages should, if possible, be performed with the guidance of the

¹ Op. cit.

² British Medical Journal, 1878, vol. ii. p. 721.

³ Lancet, London, 1878, vol. ii. p. 539.

⁴ Clifford Allbutt, British Medical Journal, March 27, 1878.

⁵ Meltzer, New York Medical Record, 1889, vol. xxxvi. p. 311.

⁶ Lagen, Poulet, op. cit., p. 72.

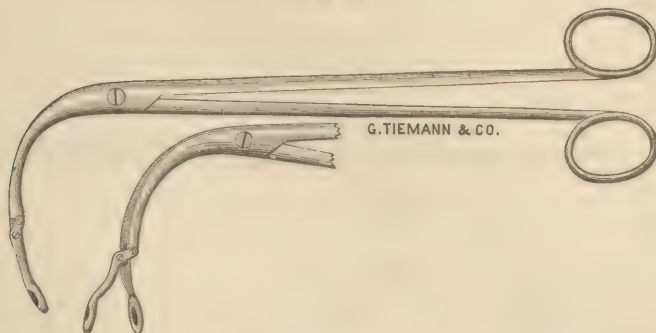
⁷ Day, London Medical Gazette, vol. ii. p. 765, cited by Gross, op. cit., p. 192.

⁸ Smolitschew, Vrach, No. 45, 1884.

⁹ Karlenski and Winternitz, Prager Medicinische Wochenschrift, 1890, No. 39.

laryngeal mirror. Gibb,¹ in 1864, was the first to detect and remove a foreign body—a pin—from the larynx by its aid, and since that time

FIG. 12.



Cusco's forceps.

there have been many examples of large and unusual substances removed in this manner.²

In some instances, when the employment of the laryngeal mirror is impracticable, the finger may be used for the purpose of extraction³ or for

FIG. 13.



Mackenzie's angular forceps.

the guidance of instruments,⁴ as where Krishaber⁵ removed a metal tag

¹ *Lancet*, London, 1864, vol. ii. p. 89.

² Briddon,—miniature velocipede,—*New York Medical Journal*, 1890, vol. li. p. 243; Joseph A. White, Richmond,—open safety-pin,—reported personally to the writer; Oertel,—set of artificial teeth,—*Schmidt's Jahrbücher*, 1868, t. cxxxviii. p. 232; Whistler,—ethmoid bone,—*Lancet*, London, 1876, vol. ii. p. 778; Ransom,—large triangular piece of glass,—*New York Medical Record*, 1891, vol. xxxix. p. 478.

³ Solis Cohen, *Philadelphia Medical News*, 1885, vol. xlvii. p. 677; Crawley, *ibid*, 1886, vol. xlix. p. 657.

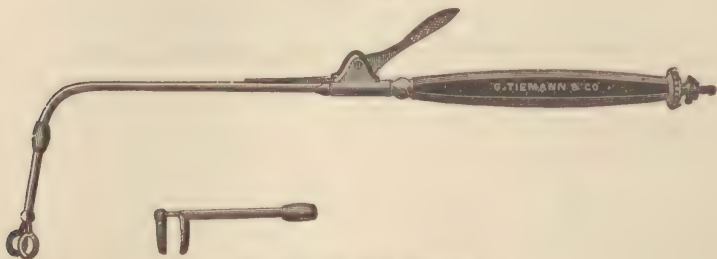
⁴ Johnson, *Lancet*, London, 1878, vol. ii. p. 501; Schadewaldt, *Deutsche Medicinische Wochenschrift*, 1884, S. 779.

⁵ *Annales des Maladies de l'Oreille, du Larynx, etc.*, 1878, tom. iv. p. 78.

from the larynx of a girl nine years old, and Major¹ a piece of nut-shell from the larynx of a child eleven months old.

In using the finger for the extraction of foreign bodies from the larynx the surgeon should exercise due care not to force the foreign body down-

FIG. 14.

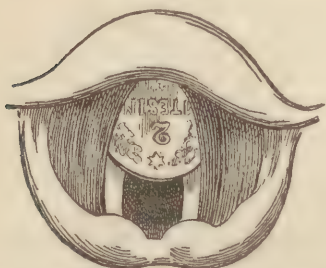


Mackenzie's tube forceps.

ward. It is advisable to place the patient's head in a pendent position, to prevent the substance from being drawn into the trachea.

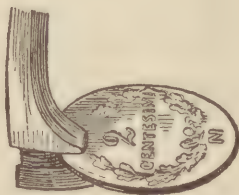
The choice of instruments is determined by the location of the foreign body. When a round or a flat substance is in the pyriform sinus, or a sharp body pierces or penetrates the epiglottis, the ary-epiglottic folds, or the ventricular bands, Cusco's lever-bladed forceps (Fig. 12) or Mackenzie's angular forceps (Fig. 13) are most serviceable. Mackenzie's tube forceps (Fig. 14) are especially serviceable when a lateral grasp is necessary, particularly if the foreign body is a coin occupying the pyriform sinus, as illustrated in Grazzi's² interesting case (Figs. 15 and 16), in which he removed a two-centesimi piece with a pair of similar forceps.

FIG. 15.



A coin in the laryngeal ventricle (Grazzi).

FIG. 16.



The same coin in the grasp of the instrument (Grazzi).

Hooks³ are frequently employed to loosen and dislodge foreign bodies impacted in the larynx when they are too firmly embedded to be removed with forceps.

A foreign body lying above the vocal cords should, as a rule, be ex-

¹ Canadian Medical and Surgical Journal, Montreal, 1886-87, vol. xv. p. 597.

² Bollettino delle Malattie dell' Orecchio, etc., 1884, No. 4.

³ Mackenzie, Diseases of the Throat and Nose, vol. i. p. 418; Schadewaldt, Deutsche Medicinische Wochenschrift, 1884, No. 48, S. 779.

tracted through the natural passages; but when lying below the vocal cords this is ordinarily not advisable, particularly if the foreign body is rough and angular and liable on extraction to lacerate the larynx sufficiently to cause permanent impairment of the voice. In some cases the removal of foreign bodies from the larynx can be safely accomplished only after the inflammation and swelling have been reduced by appropriate treatment, as in the interesting case reported by Whistler¹ in which a large, angular, flat bone was embedded between the vocal cords (Fig. 17). In a case by French, reported by Rockwell,² the bone was so caught under the cricoid cartilage that it could be removed only by tracheotomy.

FIG. 17.



b



FIG. 18.



PIECE OF BONE IN THE LARYNX (Whistler).—*a*, edge of bone seen between the vocal cords; *b*, piece of bone after extraction.

A cockle-burr in the larynx (Thorner).

Large bodies should, if possible, be crushed before extraction, as has been done in a number of instances.³

Foreign bodies in the trachea have in many instances been detected by the aid of the laryngoscope and safely extracted through the larynx. Moritz Schmidt⁴ discovered and removed from the trachea a bone, and De la Sota⁵ a leech, in this manner. Voltolini⁶ discovered a threaded needle lying just above the bifurcation. He seized the thread that was hanging out of the larynx and drew the needle upward, when it was coughed out. Hinrichs⁷ in a similar case used a probe to liberate a needle attached to a feather, and extracted it from the lower part of the trachea.

Various ingenious devices have been resorted to, as in the case where Brandeis⁸ removed a thread from the larynx by means of a brush dipped in mucilage, and Crawley⁹ a cockle-burr lodged in the larynx by entangling its prickles in cotton wound about his index finger. Max Thorner¹⁰ removed a cockle-burr (Fig. 18) from the larynx of a boy (after

¹ *Lancet*, London, 1876, vol. ii. p. 778.

² *Annals of Anatomy and Surgery*, 1881, vol. iii. p. 71.

³ *Transactions of the Pathological Society*, London, vol. xviii. p. 27; Schmidt-Langenbeck's *Archiv*, 1875.

⁴ *Archiv für Klinische Chirurgie*, 1875.

⁵ *Archives of Laryngology*, 1883, vol. iv. p. 17.

⁶ *Monatsschrift für Ohrenheilkunde*, Jahrgang xii., No. 12.

⁷ *Deutsche Medicinische Wochenschrift*, 1890, No. 37.

⁸ *American Practitioner*, 1873, p. 317.

⁹ *Medical News*, Philadelphia, loc. cit.

¹⁰ *Cincinnati Lancet Clinic*, 1886, N. S., vol. xvii. p. 93.

unsuccessful attempts with various forceps) by Voltolini's sponge method; and Voltolini¹ suggests the use of a powerful magnet externally, or magnetic probes, to dislodge needles, tacks, and the like, and facilitate their expulsion or extraction.

In adults general anæsthesia is unnecessary for the extraction of a foreign body from the larynx. A few whiffs of chloroform will ordinarily be all that is required to quiet the local irritation. In cases, however, in which the foreign body is causing much pain, cocaine² anæsthesia should be resorted to.

In children general anæsthesia is frequently required to control them and to quiet the local disturbance. The difficulties of laryngoscopy, however, during anæsthesia, particularly in children, are well illustrated by a case reported by Jurasz.³ In the case of a child twenty-two months old he was unable to obtain a view of the larynx until the child was coming out of the anæsthesia and began to cry, when he extracted the foreign body.

3. *Extraction or Expulsion through Artificial Channels.*—When expulsion or extraction of a foreign body through the natural passages has failed, its removal should be attempted through an external incision. This is often required when proper instruments are not at hand to remove it through the mouth.⁴

Bronchotomy, as Galen informs us, was first performed by Asclepiades, 100 B.C., and it was first done for the removal of a foreign body from the larynx by Fabricius ab Aquapendente.⁵

The indications for the different operations, as thyrotomy, crico-thyroid laryngotomy, laryngo-tracheotomy, tracheotomy, lateral and sub-hyoidean pharyngotomy, are determined by the nature and location of the foreign body.

(a) Thyrotomy, or thyroidotomy (division of the thyroid cartilage), is indicated when large, angular bodies are so embedded in the larynx that they cannot be moved upward or downward without lacerating the tissues, direct access to and liberation of the foreign body being necessary.⁶ This should, however, be done only in imperative cases, owing to the danger of causing permanent impairment of the voice.

(b) Crico-thyroid laryngotomy (incision through the crico-thyroid membrane) is indicated in cases of small or smooth bodies impacted in the larynx above the vocal cords, which can readily be extracted through

¹ Transactions of the Seventh International Medical Congress, London, 1881, vol. iii. p. 334.

² Blanc, *Thérapeutique Contemporaine*, No. 35, Paris, August 28, 1885; also *Internationales Centralblatt*, 1886-87, p. 19.

³ *Monatsschrift für Ohrenheilkunde*, Berlin, 1886, vol. xx. p. 369.

⁴ D'Urto, *Giornale Internazionale delle Scienze Mediche*, 1887.

⁵ *Opera Chirurgica*, Francofurti, 1620; Mackenzie, *Diseases of the Throat and Nose*, vol. i. p. 548.

⁶ Blandon, *American Journal of the Medical Sciences*, 1892, vol. iv. p. 248; Butlin,—dress-hook,—*Lancet*, London, 1871, vol. ii. p. 468.

the opening¹ or pushed upward by a sound and extracted through the mouth.²

(c) Laryngo-tracheotomy (incision through the crico-thyroid membrane, the cricoid cartilage, and the first one or two rings of the trachea) is sometimes necessary in cases of large bodies impacted in the lower part of the larynx and the upper end of the trachea.³ This operation also should be avoided as far as possible, owing to the serious effects sometimes resulting from the incision of the cricoid cartilage.

(d) Tracheotomy (superior, when the incision in the trachea is above, and inferior, when it is below the isthmus of the thyroid gland) is indicated in adults when the foreign body is in the trachea or a bronchus, and in children when it is in any portion of the air-passages. The inferior incision is generally preferred, especially in children.

(e) Pharyngotomy (lateral and sub-hyoidean) is indicated when the foreign body is so impacted in the upper part of the larynx that direct access to it is required; as in the case in which the lateral incision was performed by Wheeler⁴ for the removal of a needle transfixing the arytenoid, and the sub-hyoidean operation by Lefferts⁵ for the removal of a brass watch-ring embedded in the left ary-epiglottic fold. This was the first time that this operation was performed for the extraction of a foreign body.

Laryngotomy is frequently preferable to tracheotomy in adults, particularly in cases of sudden suffocation, on account of the readiness with which the crico-thyroid membrane can be penetrated. For this purpose Mackenzie's⁶ pocket canula containing a concealed scalpel is especially serviceable, also Holden's⁷ ingeniously devised instrument which he has designated "a possible substitute for tracheotomy or intubation." In extreme cases laryngotomy may be performed with a penknife,⁸ or a pair of sharp-pointed scissors may be plunged through the crico-thyroid membrane and the blades opened. In children tracheotomy is far preferable,⁹ as it affords greater freedom for the manipulation of instruments. When laryngo-tracheotomy or thyrotomy is necessary the tracheal incision is extended upward.¹⁰

If dyspnoea is instantly relieved by the operation, the presumption is

¹ Sir Charles Bell, *Institutes of Surgery*, London, 1838, vol. ii. p. 280.

² Powell,—piece of meat and bone,—*New York Medical Journal*, 1889, vol. i. p. 584.

³ Svanson,—two false teeth.—*Hygiea*, March, 1884, p. 172; Geoghegan,—dog's tooth, —*Dublin Medical Press*, January 24, 1849.

⁴ *Dublin Journal of Medical Science*, 1884, p. 385.

⁵ *New York Medical Record*, 1874, vol. ix. p. 641.

⁶ *Diseases of the Throat and Nose*, London, 1880, vol. i. p. 514. Illustrated.

⁷ *New York Medical Journal*, 1888, vol. xlviii. p. 645. Illustrated.

⁸ Heath,—meat,—*Lancet*, London, 1836, vol. ii. p. 343.

⁹ Hopton, *American Journal of the Medical Sciences*, Philadelphia, 1829, vol. iv. p. 534.

¹⁰ G. H. R. Holden.—dress-hook,—*British Medical Journal*, 1892, vol. i. p. 552; Beverley.—coin,—*British Medical Journal*, 1889, vol. ii. p. 14; Butlin,—dress-hook caught in the vocal cords,—*Lancet*, London, 1872 (American reprint), p. 39.

that the foreign body is in the larynx; if the dyspnoea is not relieved, it is probable that the foreign body is in the trachea, in the bronchi, or in the œsophagus, compressing the trachea.

When the foreign body is below the opening, it frequently happens that it is expelled through it during the respiratory spasm which occurs the instant the opening is made.¹ Often it is expelled through the mouth immediately² or subsequently,³ or coughed up to the opening, so that it may be seized and extracted.⁴

In the ninety-one cases collected by Durham⁵ in which spontaneous expulsion took place after tracheotomy had been performed, it was immediate in sixty-two, while in twenty-nine it was fixed, but afterwards became loosened by natural processes. In fourteen cases loosening took place in twenty-four hours, the length of time in which the largest number are expelled after operation. Often, however, the expulsion is delayed for a longer period of time,⁶ as in Brunel's⁷ case, in which the half-sovereign was expelled seventeen days after tracheotomy. In some instances the foreign body has been expelled after closure of the tracheal incision, the surgeon either having failed to detect⁸ a foreign body or having been unable to remove it.⁹

After the trachea is opened foreign bodies are frequently expelled through the larynx, and much more readily than before the operation. This may be due to the relaxation of the laryngeal muscles, the stimulating influence of the inspired air being absent, or, as Sandler explains, the air can readily enter without carrying the foreign body into the bronchi.¹⁰ After tracheotomy for a foreign body in the larynx the patient is able to fill his lungs freely, and, by closing the tracheal opening, to acquire sufficient expiratory force to dislodge the substance.¹¹

¹ Wells,—piece of melon,—*American Journal of the Medical Sciences*, 1832, vol. x. p. 28; Caswell,—shawl-pin,—*Boston Medical and Surgical Journal*, 1879, vol. ci. p. 47; Bentlif,—prune-stone,—*British Medical Journal*, 1892, vol. i. p. 1359; Foster,—plum-stone,—*Lancet*, London (American reprint), 1855, vol. ii. p. 491; Meyer,—grain of corn,—*Journal of the American Medical Association*, 1883, vol. i. p. 422.

² Groom,—bread-crumbs,—*Lancet*, London, 1880, vol. ii. p. 576.

³ Wyeth,—puff-dart,—*New York Medical Record*, 1884, vol. xl. p. 487; Conner,—puff-dart,—*American Journal of the Medical Sciences*, 1877, vol. lxxiv. p. 595.

⁴ Ward,—peanut in trachea,—*New York Medical Record*, 1886, vol. xxix. p. 10; Wharton,—portion of gourd-seed,—*Archives of Pediatrics*, 1884, vol. i. p. 51.

⁵ Holmes's *System of Surgery*, vol. ii. p. 477.

⁶ Addenbrook, *Lancet*, London, 1889, vol. ii. p. 79,—bead, four days; Bushe, *New York Medico-Chirurgical Bulletin*, 1832, vol. ii. p. 61,—piece of cocoanut, six days; Jessop, *Lancet*, London (American reprint), 1869, p. 315.

⁷ *Transactions of the Medico-Chirurgical Society*, 1845, vol. xxvi. p. 286.

⁸ Gross, *op. cit.*, p. 371,—watermelon-seeds, forty-seven days; Johnston, *Lancet*, London, 1851, vol. ii. p. 600,—hazelnut-shell, twenty-eight days.

⁹ Jewett, *Boston Medical and Surgical Journal*, 1837, vol. xvi. p. 88,—nail, thirty-three days in the trachea.

¹⁰ Poulet, *Foreign Bodies in Surgery*, vol. ii. p. 85.

¹¹ Caswell,—shawl-pin,—*Boston Medical and Surgical Journal*, 1879, vol. ci. p. 47.

If not thus removed, it may be extracted by manipulation through the mouth, or by instruments inserted through the opening for the purpose of pushing the foreign body upward, where it may be extracted by forceps, or by the aid of the finger in the mouth, as recommended by Annandale.¹ This method was employed in the case of the infant with the egg-shell in its larynx.² The body may also be pushed through the larynx with the finger and extracted through the tracheal opening.³

Another method is to attach a piece of sponge to a thread of silk and draw it through the larynx from below. Mr. Thomas Smith⁴ removed a sea-tangle tent from the larynx in this manner.

If the foreign body is in the trachea or bronchi, successive turning from the prone to the supine position, or inversion and succussion, are sometimes useful aids in expelling it. The excitation of paroxysms of coughing by tickling the trachea with a feather is occasionally of service.⁵

Blowing strongly into the trachea may assist in expelling the body,—the compression of the air increasing the expulsive force of the cough thereby excited. If these measures fail to dislodge the body, it should be carefully sought for with the finger or slender probes or hooks.

To facilitate the use of instruments, the trachea should be held open by retractors in the hands of an assistant, or by Trousseau's two-bladed tracheal dilator (Fig. 19), or Laborde's three-bladed dilator (Fig. 20), or by hooks provided with claws, inserted in the edges of the opening and tied with tape or elastic bands around the neck.⁶ Or the edges of the trachea and the integuments may be stitched together, making a permanent opening.⁷ An automatic retractor may be used, that of Golding-Bird⁸ (Fig. 21) being the best one devised for this purpose.

Exploration of the trachea is most conveniently made with the finger, with which the bifurcation can usually be reached. A long silver probe bent to a right angle may also be used, and by bending the end up into a

FIG. 19.



Trousseau's tracheal dilator.

¹ Medical Times and Gazette, February 27, 1875.

² Author's case, *ante*, p. 505; Bergmann, St. Petersburger Medicinische Wochenschrift, No. 1, 1880; Internationales Centralblatt, 1888-89, p. 346.

³ Beeston,—glass eye of doll,—Australasian Medical Gazette, 1885-86, vol. v. p. 279.

⁴ Transactions of the Medico-Chirurgical Society, London, 1865, vol. xlviii. p. 207.

⁵ Schmidt's Jahrbücher, 1876, Bd. clxx. S. 271.

⁶ Collier,—percussion-cap,—Lancet, London, 1889, vol. i. p. 116.

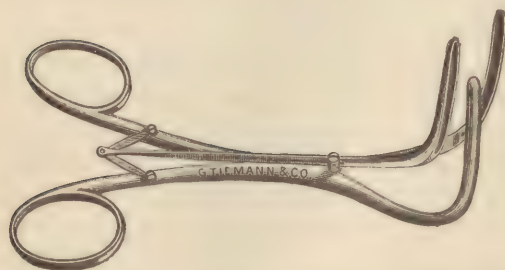
⁷ Wyeth, Medical Record, New York, 1884, vol. xxvi. p. 552.

⁸ Lancet, London, 1881, vol. i. p. 407.

hook the substance can often be extracted ; or it may be so dislodged as to be expelled by coughing. A stout, smooth copper wire or loop of silver wire¹ may be made to serve the same purpose.

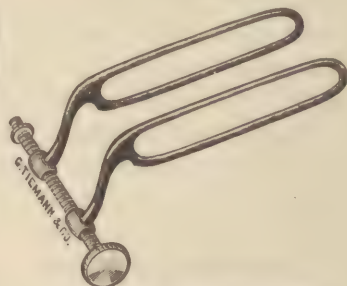
Tracheoscopic examination is often of service in detecting a foreign

FIG. 20.



Laborde's dilator.

FIG. 21.



Golding-Bird's double retractor.

body. This is done by inserting a small mirror in the wound and reflecting a strong light down the trachea. The sun's rays are far preferable to artificial light.

Gross's tracheal forceps (Fig. 22) are considered the best for extraction ;

FIG. 22.



Gross's tracheal forceps.

they are about nine inches in length, made of solid silver, flexible and quite slender, so as not to interfere with the passage of air.

Mackenzie's tube forceps (see Fig. 14) and Cohen's shouldered forceps (Fig. 23) are also excellent instruments for certain cases.

FIG. 23.



Cohen's shouldered traction forceps.

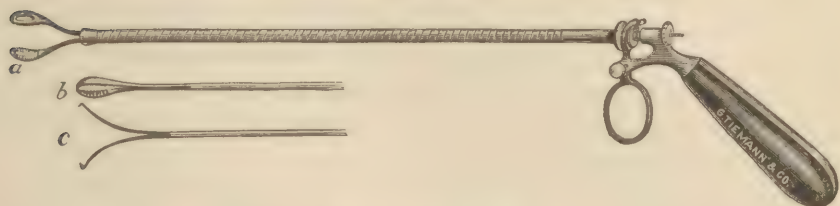
Fig. 24 represents a pair of forceps devised by the writer for extracting substances from the trachea or bronchi. This instrument consists of a slender spiral stem nine inches long, through which passes a copper wire that controls the blades. It is so constructed that the blades do not draw

¹ Habgood,—glass sleeve-link removed from trachea,—Lancet, London, 1876, vol. ii. p. 854.

back on being closed. Its advantages lie in its slenderness and in the pliability of the copper wire, whereby the instrument, retaining its position as adjusted, can be adapted to the extraction of a foreign body from either bronchus; *a*, *b*, and *c* indicate blades of different sizes and shapes.

Forceps used for extraction may at the same time serve as exploratory

FIG. 24.



Roe's tracheal forceps.

sounds; and when the foreign body is detected it can be seized and extracted.

Chloroform, according to the rule laid down by Aronssohn,¹ should not be administered during the operation of tracheotomy if suffocation is imminent, or, as observed by Gant,² if the foreign body is movable in the trachea or bronchi. After operation a small amount of chloroform will greatly facilitate the employment of instruments in the trachea, by quieting reflex irritation.

In no instance should attempts at extraction of a foreign body from the trachea or bronchi be so prolonged as to tax the endurance of the patient or to excite a local inflammation. For obvious reasons, a canula should not be introduced, although in a number of instances this has been done.³

Foreign bodies have been removed from the lower end of the trachea and from the bronchi by a great many different devices. Nearly all tracheotomy canulas that have fallen into the trachea were removed by hooks.⁴ Hows,⁵ however, removed a canula from a bronchus with curved forceps after failure with hooks. The most unique plan was the one adopted by Davy.⁶ He threaded one end of a silver probe, bent the other end up into a hook, dropped it into the trachea, and recovered the lost canula.

Weir⁷ removed a tooth from the left bronchus with a loop of silver wire which was tightened around the tooth with a pair of forceps.

By a very ingenious plan a pen-case was removed from the left bronchus

¹ Thèse de Strasbourg, op. cit.

² Science and Practice of Surgery, 2d ed., vol. ii. p. 354.

³ Clark, Glasgow Medical Journal, November, 1888; Sendler, loc. cit., p. 50; Regiani, Gazzetta degli Ospitali, Milano, 1888, vol. ix. p. 388.

⁴ Transactions of the Medico-Chirurgical Society, London, 1877, p. 85.

⁵ Ibid., p. 93.

⁶ British Medical Journal, July 8, 1876.

⁷ Loc. cit.

by Laidler.¹ He dropped a small silver plummet by the side of the foreign body, and by moving it up and down worked the body up to the orifice, and finally extracted it with forceps.

A novel though unsuccessful plan was adopted by Rushmore² for the removal of a cork that had been inhaled into the left bronchus. After having failed with forceps, he introduced a long double tube, that he had had especially constructed, through the tracheal incision down to the cork. The inner tube had two sharp prongs for transfixing and holding the foreign body, and then with a screw made to fit this tube he attempted to engage the cork after the manner of withdrawing one from a bottle; the prongs, however, failed to hold it firmly enough to accomplish the object. The patient died of exhaustion.

Bronchotomy through the chest-wall has been suggested by Quénu³ and Figueira⁴ for the removal of bodies so firmly impacted in a bronchus or so deeply lodged in the lung-tissue as to render extraction or spontaneous expulsion impossible. It is anatomically impossible to reach the primary bronchi from the front of the chest, but it is quite possible posteriorly. By throwing the left arm forward there is sufficient space between the border of the scapula and the spinal column to cut down upon and resect the ribs, and thus to reach the bronchi after the plan proposed by Naseloff,⁵ of St. Petersburg, for reaching foreign bodies impacted in the lower portion of the œsophagus. The practicability of the operation, however, remains to be demonstrated.

De Forest Willard⁶ has shown, by a number of experiments on dogs, that the operation of reaching the bronchi through the chest-walls, either anteriorly or posteriorly, is a very dangerous procedure, since it incurs greater risk than the presence of the foreign body itself. This view is concurred in by Marsh and Durham,⁷ of London.

In cases where the foreign body is impacted in the anterior or lateral portion of the chest and not too far from the surface, the writer would suggest the plan of exciting an artificial pleuritis over the location of the foreign body by the injection of irritating substances, so as to cause sufficient adhesion of the pleura to prevent collapse of the lung on opening the chest. The lung could then be incised and the foreign body extracted.

¹ British Medical Journal, 1877, vol. ii. p. 590.

² New York Medical Journal, 1891, vol. liv. p. 85; instruments illustrated; interesting on account of their novelty.

³ Bulletins et Mémoires de la Société de Chirurgie de Paris, 1891, N. S., t. xvii. p. 147.

⁴ New York Medical Journal, 1891, vol. liii. p. 687.

⁵ Vrach, No. 25, 1888; Annals of Surgery, 1888, vol. viii. p. 308.

⁶ Boston Medical and Surgical Journal, 1891, vol. cxxv. p. 418.

⁷ Ibid., p. 419.

PART II.

FOREIGN BODIES IN THE PHARYNX AND ŒSOPHAGUS.

The number and variety of foreign bodies which become lodged in the pharynx and œsophagus are quite as great as of those found in the air-passages; they are also quite similar in character to those previously described. Among them may be mentioned leeches, living fish, salamanders, worms, seat-worms, tape-worms, round-worms, mice, eels, insects, and frogs; bones, detached necrosed bones, fish-bones, fish-scales, meat, food, feathers, hearts of fowls, hydatid cysts, oysters, tooth-brushes, buttons, hair, and cartilage; tooth-plates with false teeth, palate obturators, nuts, portions of apples and pears, heads of grain and grass, toothpicks, dominoes, violin-pegs, fruit-stones, mushrooms, sponges, feeding-bottle nipples, blades of pocket-knives, fish-hooks, spoons, forks, meat-skewers, pens, pins, needles, tacks, nails, coins, beads, buckles, steel rollers, brace-buckles, pipe-bowls, metal plates, iron staples, stones, brick, pottery, whistles, glass, eye-glasses, keys and key-rings, probangs, thermometers, brooches, iron jacks, iron files, thimbles, padlocks, barbed wire, metal tooth-plates, sticks of nitrate of silver, pieces of slate, pipe-stems, knives, sounds, and œsophageal tubes.

The ordinary avenue of entrance of foreign bodies into the pharynx and œsophagus is through the mouth; although sometimes foreign substances have entered the pharynx through the neck, as in the case reported by Jardin Murray,¹ who removed a needle from the pharynx of a woman which had been thrust through her neck about half an hour previously. Grain-heads² which have been aspirated into the trachea, and substances from the posterior nares, are said to have found their way into the œsophagus. Langenbeck³ reports a case of a necrosed turbinated bone that became detached and lodged in the œsophagus. Undigested substances are sometimes vomited up from the stomach and impacted in the œsophagus.⁴

ETIOLOGY.

1. *Anatomical Conditions favoring the Lodgement of Foreign Bodies in the Pharynx and Œsophagus.*—The natural irregularities of the pharynx tend to the arrest of different substances there, and their particular location is determined by the anatomical structure of the parts, and the size, shape,

¹ Medical Times and Gazette, 1859, p. 468: several cases similar to this are here reported.

² Hévin, *Mémoires de l'Académie Royale de Chirurgie*, 1761, vol. i. p. 445.

³ *Memorabilien*, Jahrgang xii, Bd. xxii., Heft 1, 1877; New York Medical Journal, 1877, vol. xxvi. p. 97.

⁴ Hévin, *op. cit.*, p. 455; Boulard, *Archives Générales*, tom. xxiii. p. 528; Mackenzie, *Diseases of the Throat and Nose*, London, 1884, vol. ii. p. 188.

and consistency of the foreign bodies themselves. Large bodies are more likely to be arrested just above the crico-arytenoid prominence, or between the base of the tongue and the epiglottis.¹ Thin, pointed bodies are more apt to stick into or become lodged between the pillars of the fauces and the tonsils,² or in the glosso-epiglottic or ary-epiglottic folds, although bodies of this kind may be arrested at any portion of the pharynx. Long, thin bodies may become lodged in the pharynx, lying horizontally just above the larynx. Large round and angular bodies, like tooth-plates, that become impacted in the pharynx, generally lie across the lower portion at the entrance of the œsophagus.³ Coins, pins, and similar substances are usually embedded in the folds of the mucous membrane or in the pyriform sinus.⁴ Leeches are often found in the pharynx attached to the posterior or lateral walls.⁵

In the œsophagus there are normally three constricted portions:⁶ the first at the lower end of the pharynx, or entrance to the œsophagus, caused by the prominence of the cricoid cartilage; the second at the middle third of the œsophagus, opposite the first rib, where it is crossed by the left bronchus;⁷ the third at its lower portion, where it passes through the diaphragm.

The cricoid prominence gives the entrance of the œsophagus an elliptical shape, permitting the entrance of long, flattened substances much more readily than of rounded ones. Accordingly, a large, round substance whose diameter is greater than the antero-posterior diameter of the œsophagus opposite the cricoid body, if hard and unyielding, would necessarily be arrested in the pharynx; whereas if soft and pliable it might be moulded to the entrance of the œsophagus and readily pass into it. Flat or slender substances would also more readily pass this orifice than round ones of the same volume.

Bodies which pass into the œsophagus may be arrested in the middle third where it is crossed by the left bronchus, or may descend to become impacted at the cardiac extremity, which is the narrowest portion of the tube.

In many instances the size of foreign substances has exceeded the normal dimensions of the œsophagus, which necessarily became greatly distended thereby.⁸

¹ Johnson, *Lancet*, London, 1878, vol. ii. p. 500, case reported by Paget,—set of teeth; Heryng, *Gazeta Lekarska*, Warszawa, 1890, ser. ii., vol. x. p. 349.

² George White, *New York Medical Record*, 1888, vol. xxxiii. p. 387.

³ Carlyle, *Lancet*, London, 1880, vol. i. p. 994,—tooth-plate.

⁴ Subbotic, *Allgemeine Wiener Medicinische Zeitung*, 1886, vol. xxxi. p. 112.

⁵ Trolard, *Lancet*, London, 1871, p. 280 (American reprint); Duval, *Journal Général de Médecine, de Chirurgie et de Pharmacie*, Paris, 1806, vol. xxvi. p. 247; Skey, *Lancet*, London, 1861, vol. ii. p. 328.

⁶ Mouton, *Du Calibre de l'Œsophage*, Paris, 1874, p. 17; also experiments made by Mackenzie, *Diseases of the Nose and Throat*, London, 1884, p. 3.

⁷ Harrison Allen has emphasized that the curve at this point is the frequent cause of arrest of foreign bodies, *Philadelphia Medical Times*, 1877-78, vol. viii. p. 2.

⁸ Lesbros,—piece of gristle,—*Journal of the American Medical Association*, 1883, vol. i. p. 621.

2. *Pathological Conditions favoring the Lodgement of Foreign Bodies in the Pharynx and Œsophagus.*—The most frequent of these is the absence of teeth,¹ which prevents the proper mastication of food. Inflammatory affections and diseased conditions of the tongue, tonsils, pharynx, epiglottis, larynx, and Œsophagus, interfering with deglutition and inducing the sudden bolting of food in large quantities, predispose to the lodgement of foreign bodies.

Growths and glandular swellings² may, by pressing upon the pharynx and Œsophagus, cause narrowing of the tube and the lodgement of alimentary substances at that point. This is frequently the case in goitre, where the Œsophagus is entirely encircled by the enlarged gland, greatly diminishing its calibre. Several cases are reported similar to the following which recently came under the observation of the writer :

A woman aged forty-five had suffered from an increasing enlargement of the thyroid gland for ten years, which finally became so large as to cause urgent dyspnœa from pressure on the trachea, and great difficulty in swallowing solid substances. Several times pieces of meat became impacted in the Œsophagus which required instrumental extraction.

Balujew³ believes that hypertrophy of the thyroid gland frequently gives rise to the impaction of foreign bodies in the upper part of the Œsophagus. He reports three cases of this kind, in two of which the foreign body was a bone and in one a set of artificial teeth. Œsophagotomy was performed on all of these. The first two patients recovered, the third died on the tenth day afterwards.

Neoplasms and cicatricial⁴ contractions of the interior of the tube are frequent causes of the lodgement of alimentary substances in the Œsophagus.

Ashhurst⁵ reports the case of a child aged four and a half years in whose Œsophagus a piece of ham became impacted. On the seventh day she vomited some offensive green matter and felt relieved. She continued to sink, and died nine days afterwards. Autopsy revealed a strong fibrous stricture near the lower end of the Œsophagus.

Instruments used for the treatment of stricture of the Œsophagus may accidentally become impacted, requiring extraction, as in the case reported by Weir.⁶

Spasm of the muscles of the tongue, pharynx, or Œsophagus may some-

¹ Bishop, Boston Medical and Surgical Journal, 1887, vol. cxvi. p. 271.

² Sklifosovski, Annual of the Universal Medical Sciences, 1889, vol. iv. G 37; Sota y Lastra, Revista Médica de Sevilla, January 15, 1888.

³ Meditsinskoe Obozruenie, No. 15, May, 1888, cited in Internationales Centralblatt, etc., 1888-89. Bd. v. S. 528,—large goitre, tooth-plate lodged; British Medical Journal, 1890, vol. i. p. 80.

⁴ Menzel, Archiv für Klinische Chirurgie, Bd. xiii. S. 678; Bobbitt and Battle, Jr., North Carolina Medical Journal, Wilmington, 1887, vol. xx. p. 202; Balch, New York Medical Journal, 1875, vol. xxi. p. 272.

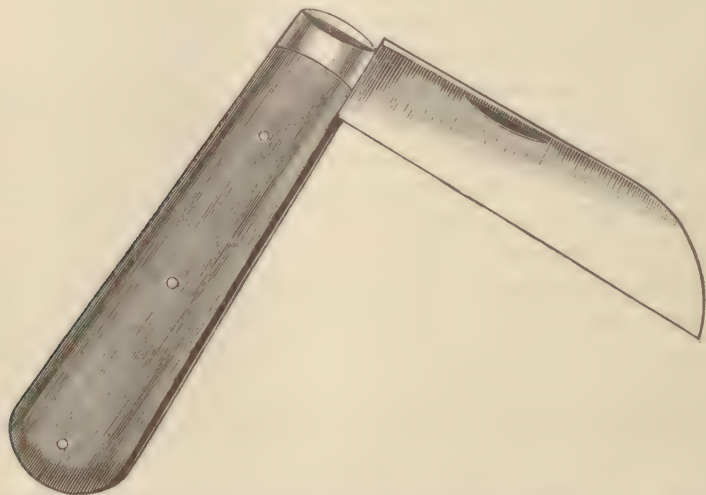
⁵ New York Medical Journal, 1875, vol. xxi. p. 272.

⁶ New York Medical Record, 1891, vol. xxxix. p. 383,—a Simon's tube.

times cause the arrest of very small substances.¹ Even so small an object as a pill may excite spasm of the œsophagus and become impacted therein. Paralysis of the deglutitory muscles and degeneration of the walls of the œsophagus, which decrease the propelling force necessary for the passage of a substance onward into the stomach, are prominent predisposing causes of the lodgement of foreign bodies in the pharynx and œsophagus. Esquirol² observes that paralysis of the œsophagus is one of the frequent causes of impaction in the insane; and cases of paralytic dysphagia are reported by Wilson.³

3. *Personal Conditions favorable to Lodgement.*—Various personal habits or characteristics of the patients themselves often occasion the lodgement of foreign bodies in the pharynx and œsophagus. One of the most frequent of these is the careless habit of holding substances in the mouth,⁴ such as pins, needles, coins, pebbles, etc., which are accidentally swallowed

FIG. 25.



Large half-opened pocket-knife removed from the œsophagus by œsophagotomy; natural size (Gussenbauer).

and become lodged in some portion of the canal below. In one instance a large half-opened pocket-knife⁵ was swallowed during violent coughing (Fig. 25).

Among the fishermen along the coast of southern France, it is a common practice to grasp and crush the fish to death with the teeth while rebaiting the hook. In several instances they have slipped through the teeth and become impacted in the air-passages, pharynx, or œsophagus. Such cases

¹ Hays, *Post-Graduate*, New York, 1887-8, vol. ii. p. 858.

² *Annales d'Hygiène Publique*, 1829, No. 1, p. 141.

³ *Recueil Périodique*, t. v.; Poulet, vol. i. p. 70.

⁴ Freeland,—silver dollar,—*Medical Record*, New York, 1891, vol. xl. p. 511.

⁵ Gussenbauer, *Deutsche Medicinische Wochenschrift*, Berlin, 1876, Bd. ii. p. 20.

are reported by Mitter,¹ Paul,² Stewart,³ White,⁴ and Anthoniesz.⁵ According to Poulet,⁶ this accident is most likely to occur with that curious animal the *Anabas scandens* of the Ganges, which, owing to certain peculiarities of its fins, possesses the faculty of jumping.

Dantra⁷ reports a remarkable case where a live fish entered the œsophagus of a man while swimming.

Substances may be swallowed by accident, as in the extraordinary case of a blacksmith⁸ who was killed while forging a key, a red-hot fragment of which flew into his throat and lodged in the œsophagus.

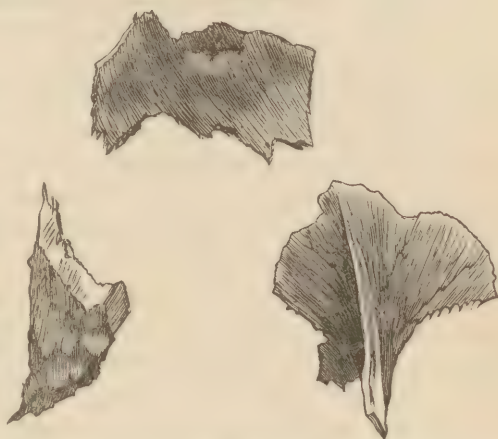
Hévin⁹ cites the case of a singer into whose widely-opened mouth a chestnut was thrown, which lodged in the œsophagus, producing serious symptoms.

Children, who have the habit of putting substances into their mouths, are very liable to this mishap. In one instance a child attempted to swallow six needles and the needle-case.¹⁰

Hurried eating, particularly of meat-soup, which is so liable to contain fragments of bones¹¹ (Fig. 26), as well as the swallowing of large pieces of unmasticated food which may also contain undetected pieces of bone,¹² often leads to this accident.

Kirby¹³ reports the case of a woman brought to the hospital in a dying

FIG. 26.



Specimens of irregular fragments of bone lodged in the œsophagus; natural size (Museum of Val-de-Grâce) (Poulet).

¹ Indian Medical Gazette, Calcutta, 1879, vol. ix. p. 98.

² Medical Times and Gazette, London, 1874, vol. i. p. 486.

³ Lancet, London, 1869, vol. ii. p. 434.

⁴ New York Medical Press, 1860, N. S., vol. iii. p. 41.

⁵ Lancet, London, 1854, vol. ii. p. 410.

⁶ Op. cit., vol. i. p. 66.

⁷ Indian Medical Gazette, Calcutta, 1878, vol. xiii. p. 245.

⁸ Bierfreund, Medicinische Zeitung Russlands, 46, 1848, cited by Mackenzie, vol. ii. p. 187.

⁹ Hévin, op. cit.

¹⁰ Adams, Gazette des Hôpitaux, 1857, t. xxx. p. 376.

¹¹ Abutkoff, Proceedings of the Riga Russian Medical Society, 1889, p. 61. The dangers of improperly-prepared food were first emphasized by Bégin, who called the attention of the authorities to the frequency of this accident among soldiers, occasioned by eating soup containing broken pieces of bone.

¹² Hévin cites numerous instances of this kind, Mémoires de l'Académie Royale de Chirurgie, 1743, tom. i. p. 446.

¹³ Dublin Hospital Reports, 1818, vol. ii. p. 224.

condition. She had been greedily eating the refuse food given her by a servant, when a piece of meat containing a bone stuck in her throat, and she died before anything could be done for her relief. The bone was impacted above and behind the cricoid prominence, occluding the larynx.

The desire for amusement¹ and the performance of special feats are also frequent causes of this accident. Jugglers and those who attempt to imitate them in their dexterity in throwing coins and other substances into the air and catching them in their mouths frequently find them lodged in the pharynx and œsophagus. Interesting cases are reported similar to the following which came under the notice of the writer :

A young man in a semi-intoxicated condition was amusing himself and his companions by tossing up coins and catching them in his mouth. Early the following morning he became painfully aware that a substance was lodged in his gullet. It was removed and found to be a silver dollar, which had become impacted at the middle third of the œsophagus.

Foreign substances which are swallowed on a banter or for purposes of concealment² are frequently impacted in the œsophagus.

Thompson³ reports the case of a man who attempted to swallow a quarter of a pound of beefsteak, which became impacted in the œsophagus, causing instant suffocation.

The vagaries of the insane cannot better be illustrated than by the numerous cases reported in literature where they have, from various motives, swallowed foreign bodies. Illustrative cases are related by Baraffio,⁴ Dove,⁵ Leeper,⁶ Stroem,⁷ Bull,⁸ Stimson,⁹ and others.

During sleep¹⁰ foreign substances, such as tooth-plates, etc., have frequently become impacted in the œsophagus, while the patients sometimes remained unaware of their presence on waking.¹¹

An interesting case is reported by Langenbeek¹² in which a necrosed portion of the nasal bones became detached and fell into the œsophagus during sleep.

Substances are sometimes mischievously introduced into the mouths of sleeping persons, as in the case reported by Leroy¹³ of a little boy who,

¹ Poulet, *op. cit.*, vol. i. p. 67.

² *Ibid.*, p. 65.

³ Dublin Journal of Medical Science, 1888, 3d ser., vol. lxxxv. p. 259.

⁴ Lancet, London (American reprint), 1873, p. 116.

⁵ *Ibid.*, vol. ii. p. 526.

⁶ British Medical Journal, 1892, vol. i. p. 709.

⁷ Journal of Laryngology and Rhinology, 1888, vol. ii. p. 208.

⁸ Lunatic swallowed stones to improve his voice, New York Medical Journal, 1886, vol. xliii. p. 330.

⁹ New York Medical Journal, 1888, vol. xlvii. p. 719.

¹⁰ MacLean, New York Medical Record, 1884, vol. xxvi. p. 281; Alexander, Lancet, London, 1879, vol. i. p. 155; Thompson, British Medical Journal, 1885, vol. i. p. 430.

¹¹ Carlyle, Lancet, London, 1880, vol. i. p. 994.

¹² *Loc. cit.*

¹³ Revue Médico-Chirurgicale de Paris, 1847, t. ii. p. 110.

finding his mother asleep with her mouth open, introduced a hook attached to a line. The mother suddenly awaking involuntarily swallowed the hook, which, after passing several inches down, penetrated the walls of the gullet.

During the period of unconsciousness of epileptic seizures¹ foreign bodies are frequently impacted in the pharynx and Œsophagus, as in the case reported by MacCormac² (Fig. 27).

Baud³ relates the case of a boatman's children, aged four and five years respectively, who agreed to play at fishing, the elder persuading the younger to take the part of the fish. The hook was baited with a tempting morsel, and the younger boy, having played around it for some time after the manner of fishes, seized it with his mouth and swallowed it. The youthful angler at once jerked the line and hooked the "fish" near the lower end of the gullet.

In some instances living bodies, such as mice, frogs, adders, and eels, are said to have crept into the mouths of persons during sleep and become impacted in the pharynx and Œsophagus.⁴

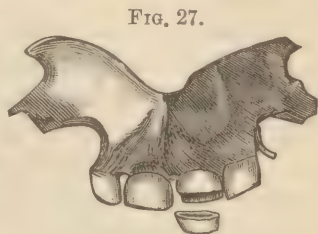


FIG. 27.

Tooth-plate impacted in the Œsophagus during an epileptic seizure (MacCormac).

SYMPTOMS ATTENDING LODGEMENT.

1. *Immediate Symptoms.*—The immediate symptoms attending the lodgement of a foreign substance in the pharynx or Œsophagus are usually dyspnoea and laryngeal spasm, dysphagia and pain, and spasmodic contraction of the Œsophagus.

When the immediate symptoms are alarming they are caused by the lodgement of the substance in such a manner as to interfere with respiration. Thus, a substance may be lodged in the pharynx in such a manner as to obstruct the larynx, or in the Œsophagus so as to compress the trachea,⁵

¹ Dawson,—tooth-plate,—*Lancet*, London, 1891, vol. ii. p. 14; Gouguenheim,—tooth,—*Annales des Maladies de l'Oreille, du Larynx, etc.*, 1891, tom. xvii. p. 482; Sympson, *British Medical Journal*, 1885, vol. ii. p. 544; Carlyle, *Lancet*, London, 1880, vol. i. p. 994.

² *Lancet*, London, 1886, vol. i. p. 1019.

³ *Revue Médico-Chirurgicale de Paris*, 1847, t. ii. p. 110; Mackenzie, *Diseases of the Throat and Nose*, p. 187.

⁴ Poulet on *Foreign Bodies in Surgery*, vol. i. p. 67.

⁵ Krieger,—a man suffocated by a bolus of food, and a woman by a piece of pancake at the base of the tongue pressing the epiglottis downward,—*Inaugural Dissertation*, June, 1884; Graefe and Walther's *Journal de Chirurgie*, vol. xvi.; Heath,—piece of meat,—*Lancet*, London, 1886, vol. ii. p. 343; Lesbros,—large piece of meat,—*Journal of the American Medical Association*, 1883, vol. i. p. 621; Poulet, *op. cit.*, vol. i. p. 97; Roberts, *Bryant's Manual of the Practice of Surgery*, Philadelphia, 1882, p. 451; Dessault, *Œuvres*, tom. ii. p. 261; Halstead, *New York Medical Journal*, 1884, vol. xxxix. p. 226,—fibro-cartilage.

or to produce so much irritation as to excite spasm of the glottis¹ which may sometimes prove fatal. Roche² relates the case of a man who attempted to swallow a piece of meat so large that it became impacted in the pharynx and he died of suffocation almost immediately. Similar cases of suffocation produced by impaction in the pharynx are reported by Ferrus³ and Wilkinson.⁴

In two cases reported by Graefe and Walther suffocation resulted from the impacted food pressing the epiglottis downward.

It is often the case where there is no immediate danger of suffocation that the irritation produced will be so great as to alarm the patient. In other cases the patient may be less susceptible to irritation, or the substance may be non-irritating in its character, and be lodged in such a way as to remain almost unnoticed.

Thompson⁵ reports the following case. A man, aged thirty-four, awoke at four A.M. and found his throat sore. This passed off, and he slept again. On rising and looking for his tooth-plate, he could not find it. His family continued the search while he went for a walk, and, not finding it, the gentleman concluded he had swallowed it. He consulted a physician, who could detect nothing abnormal in his throat and œsophagus, and as the patient found, two weeks afterwards, a tooth in the yard which he felt sure belonged to his plate, he decided that it had not been swallowed. Nineteen days after the accident a piece of bone stuck in his throat, and on his endeavoring to "hawk" it up the tooth-plate made its appearance also. This was followed by only a slight soreness of the throat.

More or less irritation and minor disturbance are caused by small bodies, such as pins, needles, fish-bones, tacks, and the like, that so often become lodged in the region of the epiglottis and lower portion of the pharynx. The sensation is usually of a pricking, tickling character, producing cough, gagging, and constant efforts at dislodgement.

Not infrequently a patient will insist that a foreign body is still in the throat even after it has been expectorated or swallowed.⁶ This sensation is caused by the irritation which continues for a time after the substance is dislodged.

Dysphagia is usually proportionate to the amount of pain occasioned by the act of deglutition when the foreign body is in the pharynx, though at times pain may be absent. In other cases dysphagia is due entirely to

¹ Bryant's Manual for the Practice of Surgery, Philadelphia, 1882, p. 451,—piece of pudding impacted in the œsophagus of a child two years old; De Mees, Journal des Sciences Médicales de Louvain, 1880, tom. v. p. 56,—screw; Krieger, Inaugural Dissertation, June, 1884; Heath, Lancet, London, 1886, vol. ii. p. 343,—piece of meat; Morgan, *ibid.*, 1882, vol. ii. p. 565.

² Bulletin de la Société Médicale de l'Yonne, Auxerre, 1875, tom. xi. p. 29.

³ Gazette des Hôpitaux, Paris, 1830–31, tom. iv. p. 120.

⁴ Dublin Medical Press, 1859; also Poulet, *op. cit.*, tom. ii. p. 31.

⁵ British Medical Journal, 1885, vol. i. p. 430.

⁶ See "Imaginary Symptoms," p. 542.

obstruction of the œsophagus. Sharp, angular bodies may cause acute pain, which is increased by the movements of the body and especially when the head is thrown backward.¹

Large smooth bodies produce dull pain by reason of the pressure and distention of the tube. Small smooth bodies usually produce only a vague sense of discomfort or cause obstruction of the œsophagus by exciting spasmodic contraction² which may be devoid of pain.

2. *Remote Symptoms*.—On the removal of the foreign body the primary symptoms usually subside. It is often the case, however, that sufficient laceration has taken place to produce inflammation and serious secondary disturbance. It far more frequently occurs, however, that secondary symptoms are due to the presence of a foreign body which remains undetected after the primary symptoms have subsided.

These secondary symptoms are usually cough and expectoration, with alteration of the voice,³ hemorrhage,⁴ and emphysema.⁵

The cough may be of a violent or spasmodic character, and the expectorations tinged with blood, if there has been laceration of the tissues, or if ulceration of the soft parts has taken place.

Bloody expectoration, and even hæmoptysis,⁶ may appear as a symptom accompanying the lodgement of a foreign body in the œsophagus, produced by ulceration extending through the walls of the trachea. Intermittent hæmoptysis is indicative of the lodgement of a leech in the pharynx or œsophagus.⁷ Professor Stromeyer⁸ reports the case of a needle that had been swallowed, which pierced the trachea and produced bloody expectoration.

The voice may be hoarse or of a metallic character if sufficient direct or reflected disturbance has been excited in the larynx.

Vomiting of pus is indicative of the rupture of an abscess that may have resulted from the presence of a foreign body in the œsophagus. Sudden oppression of the chest, great febrile disturbance, syncope, or collapse may be indicative of an œsophageal abscess opening into the cavity of the chest.

Sometimes profuse hemorrhage is a symptom of laceration of the deeper

¹ Frew, *Annals of Surgery*, St. Louis, 1888, vol. vii. p. 187.

² Hays, *Post-Graduate*, New York, 1887-88, vol. ii. p. 358.

³ MacLean,—tooth-plate,—*New York Medical Record*, 1884, vol. xxvi. p. 281.

⁴ Ivanoff,—fish-bone,—*Proceedings of Kostroma Medical Society*, September 29, 1888; also *Journal of Laryngology and Rhinology*, 1889, vol. iii. p. 420.

⁵ Meyer, *American Journal of the Medical Sciences*, 1877, vol. lxxiii. p. 29; Morgan,—piece of meat,—*Lancet*, London, 1882, vol. i. p. 565; Osler,—bone,—*Montreal General Hospital Reports*, 1880, vol. i. p. 300; Major,—meat,—*Montreal, Canada*, reported personally to the writer.

⁶ Routh, *London Journal of Medicine*, 1850, vol. ii. p. 582; Frew, *op. cit.*

⁷ Massei, *Archivii Italiani di Laringologia*, Napoli, 1889, vol. xi. p. 150; Nafiz Pasha,—intermittent hæmoptysis from a leech lodged in the pharynx for six months,—*Revue Méd.-Pharm.*, Constantinople, 1890, tom. iii. p. 69.

⁸ Cohen, *Diseases of the Throat and Nose*, p. 319.

structures by a sharp body.¹ Such cases are reported by Little,² Frew, and Bazy.³ In a case reported by Rivington⁴ a small fish-bone penetrated the lateral wall of the pharynx of a child aged nine years. On the ninth day hemorrhage occurred which required the ligation of the common carotid artery. Hemorrhage is, however, usually a secondary symptom, occurring after ulceration has opened some important blood-vessel,⁵ and may be the first evidence of the presence of a foreign body.

Emphysema⁶ of the neck and upper part of the chest is sometimes the immediate effect⁷ of the laceration of the tissues or the remote effect of ulceration.

In some cases the train of symptoms attending the lodgement of a foreign body in the pharynx or Œsophagus may be such as to simulate phthisis. Usually, however, these rapidly subside on the removal of the foreign body, as in the following case reported by Gauthier de Claubry.⁸ A girl got a piece of bone in her throat while eating soup. She became aphonic, feverish, lost flesh, and had a troublesome cough, with thick, blood-stained expectoration. This continued for fourteen years, when she was thought to be in the last stages of phthisis. Her neck was tender to the touch, so that manipulation caused her to vomit, which expelled the bone. Her health was soon after completely restored.

Similar cases, in which all the symptoms of phthisis attended the retention of foreign bodies, are reported by Courtenay,⁹ Abbe,¹⁰ and others.

3. *Imaginary Symptoms*.—It is not an infrequent occurrence for persons to present themselves for the extraction of imaginary foreign bodies.¹¹ The sensation of an imaginary foreign substance in the throat is, however, real. It may be caused by the irritation following the swallowing of some substance which has abraded or irritated the throat; but in nearly all cases it is due to a diseased condition, which should not be overlooked. Patients (usually nervous women) will apply for the extraction of hairs, threads, pieces of corn or peanut-shells, and the like, when none are present, and the supposed location of the object will, apparently, change from day to

¹ New York Medical Journal, 1883, vol. xxxvii. p. 497.

² Annals of Surgery, loc. cit.

³ La France Médicale, Nos. 37, 43, and 44, 1888.

⁴ Lancet, London, 1885, vol. ii. p. 805.

⁵ Watts, Army Medical Department Reports for 1882, vol. xxiv. p. 316, London, 1884.
(For other interesting cases of this kind, see "Diseased Conditions," *infra*.)

⁶ Sée, Bulletin et Mémoires de la Société de Chirurgie de Paris, 1875, N. S., tom. i. p. 271.

⁷ Morgan, Lancet, London, 1882, vol. ii. p. 565.

⁸ Journal de la Société de Médecine de Paris, t. xxiv. p. 13, cited by Mackenzie, vol. ii. p. 189.

⁹ Journal of Mental Science, London, 1888-89, vol. xxxiv. p. 589.

¹⁰ Tooth-plate in Œsophagus one year,—New York Medical Journal, 1886, vol. xliii. p. 503.

¹¹ Vide "Fancied Bodies," Cohen, Diseases of the Throat and Nasal Passages, p. 320; Thorner, New York Medical Journal, 1890, vol. li. p. 95.

day. This sensation may be caused by ulceration or disease about the tonsils, pharynx, larynx, or œsophagus,¹ or it may be a reflex disturbance. It is most often caused by glandular hypertrophy at the base of the tongue. Probably the most remarkable and interesting case of imaginary foreign body is the one reported by Savitzky.² He was summoned at night to attend a stout, thick-necked gentleman who, while eating supper, supposed he had swallowed his false teeth. He was suffering from a high degree of cyanosis, extreme dyspnœa, intense congestion and protrusion of the eyeballs, weakened pulse, and general excitement. On palpation, something like a hardish tumor could be felt at the clavicular level, but all attempts to grasp it with instruments utterly failed, the instrument each time becoming so tightly fixed at the point that it could be withdrawn only with great difficulty. His condition rapidly growing worse, external œsophagotomy was performed, but, no foreign body being found, it was supposed that the plate had passed into his stomach. When this fact was communicated to the patient, he was at once seized with an excruciating pain about the epigastrium, which increased until the next morning, when the set of teeth was accidentally found among some rubbish under his sofa. It was shown to the patient, and produced a magical effect, all the painful symptoms vanishing immediately. In about three weeks the œsophagotomy wound was entirely healed, and the patient recovered.

TOLERANCE AND MIGRATION.

1. *Tolerance*.—In exceptional cases foreign bodies may remain for a considerable time in the pharynx and œsophagus without exciting active symptoms. This condition is known as tolerance. In the pharynx, this occurs usually in cases of round, smooth bodies.

Shoemaker³ describes the case of a child in whose pharynx a thin brass disk three-fourths of an inch in diameter had been lodged behind the velum palati for eight months.

In a case reported by MacLean⁴ a tooth-plate remained in the œsophagus of a man for ten years before it excited painful symptoms.

Cases are reported where foreign bodies have been found lodged in the œsophagus at an autopsy⁵ which were not suspected during life, or they have been found accidentally⁶ when exploring the œsophagus for other purposes.

In all cases where foreign bodies have remained in the œsophagus with-

¹ Mackenzie in two instances removed polypi from the œsophagus with an umbrella probang, which was introduced because the patients believed they had foreign bodies in the throat: *op. cit.*, vol. ii. p. 103.

² Vrach. St. Petersburg, 1889, vol. x. p. 574; also, *University Medical Magazine*, Philadelphia, 1889-90, vol. ii. p. 252.

³ *Annual of the Universal Medical Sciences*, 1891, vol. iv. p. 3, section E.

⁴ *New York Medical Record*, 1884, vol. xxvi. p. 281.

⁵ Lesbros, *Archives de Médecine et de Pharmacie Militaires*, Paris, 1883, tom. ii. p. 281.

⁶ Guelton, *La Presse Médicale Belge*, Bruxelles, 1885, tom. xxxvii. p. 297.

out disturbance, they have been of such a form, or have been so situated, as not to interfere with the passage of food; for example, flat bodies, as coins, or flat pieces of bone, or bodies that are thin or more or less elongated. In all these cases the body must lie parallel to the long axis of the œsophagus, in order that the free passage of food may not be interfered with.

Sometimes a foreign body may cause a fusiform pouch¹ or a diverticulum,² as observed by Rokitsansky³ and Monti,⁴ in which the foreign body may be lodged as in a pocket, away from the channel for the passage of food. A very interesting case of this kind is reported by Silver.⁵ Fig. 28 shows the location of the body in the diverticulum.

In other instances foreign bodies may become more or less encysted.

The following interesting case of encysted foreign body is given by Leroy MacLean⁶ (Fig. 29). A man, thirty-six years of age, swallowed a rubber tooth-plate one and one-half inches in width and one and one-quarter inches deep. He continued well for ten years thereafter, only suffering slight inconvenience when large morsels of food were swallowed. Twelve years and two months after the accident he was seen by MacLean. He was then unable to swallow solid food, was much emaciated, and most of the liquid nourishment taken was regurgitated. Œsophagotomy was performed, and after prolonged efforts the plate was extracted with forceps. The plate was

FIG. 29.



Tooth-plate (MacLean).

found entirely encysted, with the exception of a tip of one of the wings. The patient died forty-eight hours after the operation.

2. *Migration*.—The tendency of foreign bodies to change their position and location is well known; but they are much less subject to these changes in the œsophagus than in the trachea. Irregular or irritating substances do so by ulcerating their way through the tissues, and sooner or later make themselves manifest by abscesses or by alarming, sometimes fatal, hemorrhage.⁷ Sharp, slender, and non-irritating substances, like needles and pins, may make their way safely through the tissues to the surface of the body, appearing perhaps at some remote part, or they may pierce the lung.⁸

Foreign bodies migrating from the pharynx usually make their exit

¹ Abbe, loc. cit.

² Tusa, *La Riforma Medica*, August 27, 1891.

³ *Manual of Pathological Anatomy*, vol. ii. p. 12 (printed for Sydenham Society, London).

⁴ *Jahrbuch für Kinderheilkunde*, October 20, 1875.

⁵ *New York Medical Journal*, 1891, vol. liv. p. 656.

⁶ *New York Medical Record*, 1884, vol. xxvi. p. 281.

⁷ Renaudin, *L'Union Médicale et Scientifique du Nord-Est*, Reims, 1880, tom. iv.

p. 146.

⁸ Cohen, *Diseases of the Throat and Nose*, New York, 1879, p. 319.

FIG. 28.



Tooth-plate lodged in a diverticulum in the œsophagus for nearly two years. The patient insisted that the plate was in her œsophagus, but exploration failed to detect it during life (Silver).

through the neck.¹ Those migrating from the œsophagus follow the course of the tissues and come to the surface either in the neck, arms, or axilla. Cases in which "corn-stalks"—evidently heads of bearded grain—were lodged in the œsophagus and extracted from abscesses of the chest-walls are reported by Hévin,² Vigla, Bonet, Helmontius, Volgnarius, Polisius, and Bally.³

Different substances swallowed by one person at the same time may emerge through as many different abscesses.⁴

In some instances pieces of bone have been forced through the walls of the œsophagus during attempts at propelling them into the stomach, which afterwards made their exit through abscesses in the anterior portion of the neck above the manubrium sterni. Such cases are reported by Fortuner⁵ and Meyer.⁶

DISEASED CONDITIONS.

Notwithstanding the fact that foreign bodies sometimes remain in the pharynx and œsophagus without exciting active trouble, in the majority of cases they cause secondary disturbances which very frequently lead to the death of the patient. The conditions which may arise are: (1) œdema of the larynx; (2) abscesses; (3) ulceration; (4) stricture; (5) perforation of the walls of the œsophagus and important blood-vessels; (6) penetration of the pericardium and heart; (7) penetration of the pleural cavity, lungs, and bronchi; (8) caries of the vertebræ; and (9) rupture of the œsophagus.

1. *Œdema of the larynx* occurs only when the foreign body is located in the pharynx⁷ or upper portion of the œsophagus.⁸ Anderson⁹ reports a case in which a piece of nitrate of silver, mistaken for a pill, lodged in the pharynx, corroded the tissues, and caused œdema of the larynx and death, notwithstanding that tracheotomy was performed.

2. *Abscesses* result from injury or penetration of the soft parts. Clark¹⁰ reports the case of a child in whom a piece of tin embedded in the anterior wall of the pharynx produced an abscess which perforated the right posterior half of the larynx and caused death. Postnikoff¹¹ reports a case in

¹ Lavacherie, Bulletin de l'Académie de Médecine Belge, 1848.

² Mémoires de l'Académie Royale de Chirurgie, Paris, 1743, tom. i. p. 561.

³ Cited by Poulet, op. cit., vol. i. p. 84.

⁴ Hévin, op. cit.

⁵ Recueil de Mémoires de Médecine, de Chirurgie et de Pharmacie Militaires, 1834, tom. xxxvi. p. 253,—bone expelled after three months.

⁶ Inaugural Dissertation, Berlin, 1881, p. 23,—bone expelled after two and a half years.

⁷ White, Medical Record, New York, 1888, vol. xxxiii. p. 387.

⁸ Cheever, Boston Medical and Surgical Journal, 1882, vol. cvi. p. 272; Monti, Jahrbuch für Kinderheilkunde, Wien, 1865, Bd. vii. Heft 3, S. 62.

⁹ Lancet, London, 1876, vol. ii. p. 177.

¹⁰ Indian Medical Gazette, Calcutta, 1885, vol. xx. p. 78.

¹¹ Vestnik Obshtchestvennoi Higieny, Sudebnoi i Prakticheskoi Meditsiny, February, 1890, p. 69; Journal of Laryngology and Rhinology, 1890, vol. iv. p. 382.

which a copper coin (a kopeck) embedded in the lower part of the pharynx caused acute suppurative inflammation of the lungs. Similar cases are reported by Atlee,¹ Wallace,² and Justi.³

Abscesses of the œsophagus are located in the walls of the tube or in the peri-œsophageal cellular tissue. The former generally open into the interior of the tube, while the latter usually open externally and may involve the different tissues of the neck and chest, as the trachea,⁴ the pleural cavity,⁵ the pericardium⁶ and heart, the anterior⁷ and posterior⁸ mediastinum.

Abscesses located in the upper third or cervical portion of the œsophagus may find their way through the tissues of the neck and open externally; the foreign body may be removed through this opening, as in the interesting case reported by Balujew.⁹ Abscesses opening into the pleural cavity, causing empyema, may also be incised and the patient recover, as in the case reported by Busch.¹⁰

Abscesses in the brain may be the result of septic absorption from the suppurating process set up by the foreign body in the œsophagus. Such a case is reported by Rivington.¹¹

3. *Ulceration* may result from secondary inflammation or from the caustic nature of the foreign body itself, and ultimately may cause stricture or perforation of the œsophagus and of important blood-vessels.

4. *Stricture* resulting from the impaction of a foreign body in the œsophagus is illustrated by the case reported by Franks.¹² A girl aged twenty-seven had suffered for four years from gradually-increasing dysphagia following the impaction of a hard piece of bread-crust in the œsophagus. Two cases similar to the above have come under the observation of the writer. In one case, that of a man fifty-five years of age, the dysphagia was attributed to the lodgement of a fish-bone in the œsophagus fifteen years before. In the other case,¹³ that of a woman forty-eight years old,

¹ Philadelphia Medical Times, 1884-85, vol. xv. p. 473.

² Proceedings of the Medical Society of the County of Kings, Brooklyn, 1883-84, vol. viii. p. 164.

³ Deutsche Zeitschrift für Chirurgie, 1882, Bd. xvii. S. 158.

⁴ Lindenbaum, Vrach, St. Petersburg, 1885, vol. vi. p. 356; Antonow, Bolnitchnaia Gazeta Botkina, No. 13, 1890, p. 306.

⁵ Buttenberg, Centralblatt für Nervenheilkunde, Psychiatrie, u. s. w., September, 1891.

⁶ Eve, Lancet, London, 1880, vol. i. p. 448,—fish-bone; Bulst, Charleston Medical Journal, 1858, vol. xiii. p. 41,—fatal pericarditis.

⁷ Bussard, Recueil de Mémoires de Médecine, de Chirurgie et de Pharmacie Militaires, 1874, tom. xxx. p. 221.

⁸ Osler, Montreal General Hospital Reports, 1880, vol. i. p. 300; Van de Warker, New York Medical Journal, 1871, vol. xiii. p. 453; Sée, Bulletin et Mémoires de la Société de Chirurgie de Paris, 1875, N. S., tom. i. p. 271,—pen in the pharynx.

⁹ Meditsinskoe Obozrainie, Moskva, No. 15, 1888; cited in Internationales Centralblatt, 1888-9, Bd. v. S. 528.

¹⁰ Archiv für Klinische Chirurgie, 1874, Bd. xvi. S. 68.

¹¹ Lancet, London, 1885, vol. ii. p. 805.

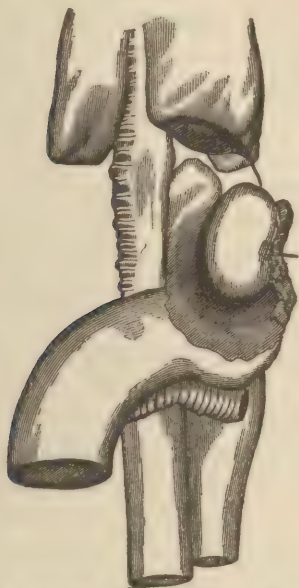
¹² Medical Press and Circular, London, 1882, N. S., vol. xxxiii. p. 335.

¹³ Transactions of the American Laryngological Association, 1888, p. 46.

there had been increasing dysphagia following the impaction of a piece of chicken in the œsophagus fourteen years previously. Internal œsophagotomy in this case was successfully performed.

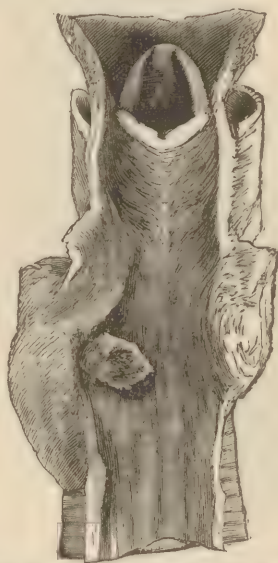
5. *Perforation of the Œsophagus and Blood-Vessels.*—Foreign bodies in the œsophagus may perforate its walls by direct penetration (Fig. 30) or by ulceration, and in some instances cause fistulous communication with the trachea,¹ and may even pass through into it (Fig. 31).

FIG. 30.



Pin perforating the œsophageal ganglion (Dagron).

FIG. 31.



Perforation of the œsophagus and trachea by piece of bone (after Poulet) (Dupuytren's Museum).

Gerster² reports a case in which a flat button swallowed by a child twelve months old ulcerated through into the trachea. At the autopsy the button was found lodged between the œsophagus and the trachea, projecting into the trachea.

Substances in the pharynx sometimes cause erosion of the common carotid artery, as in cases reported by Bell³ and Fingerhuth.⁴ Substances lodged in the œsophagus most frequently perforate the aorta, owing to the proximity of these organs. Poulet⁵ cites seventeen cases in which this took place. It

¹ Cohen, *Diseases of the Throat and Nose*, p. 313,—tooth-plate swallowed during sleep one year previously.

² *Journal of the American Medical Association*, 1886, vol. vi. p. 585; see also Paterson's case, *Edinburgh Medical and Surgical Journal*, 1848, vol. lxxi. p. 125; Castle, *Medical News*, Philadelphia, 1884, vol. xlv. p. 299.

³ *Medical Gazette*, 1842-43, p. 694.

⁴ *Preussische Vereinszeitung*, N. F., vii., No. 23, 1864.

⁵ *Op. cit.*, vol. i. p. 91.

sometimes occurs as a primary result from direct perforation of the vessel by a sharp body.¹ It is usually, however, by a slow process of ulceration² and gangrene of the parts, extending through into the vessels in from ten to twenty-five days,—although occasionally a much longer period elapses.

FIG. 32.



Perforation of the œsophagus and aorta by a five-franc piece (after Poulet, from Denouvilliers) (Dupuytren's Museum).

Pillot³ reports the case of a man who swallowed a fish-bone which was extracted the following day by a sponge probang. Three days later violent hemorrhages occurred, which continued until he died shortly afterwards. Post-mortem examination showed a perforation in the lower third of the œsophagus, and a corresponding perforation of the descending aorta. A similar case is reported by Colles.⁴ In case of coins the erosion may take place so insidiously as not to manifest itself in any way, as illustrated by the case reported by Martin:⁵

A corporal, without previous symptoms, had a hemorrhage, which recurred the next day with greater violence, and death followed ten minutes later. It was then learned that he had been in the habit of swallowing coins for the amusement of others. Autopsy revealed erosion of the aorta from the presence of a coin in the œsophagus. Fig. 32, from Poulet, illustrates the position of the coin.

All other vessels lying in proximity to the œsophagus may be perforated. Cases are reported in which the common carotid,⁶ subclavians,⁷ inferior thyroids,⁸ pulmonary,⁹ œsophageal,¹⁰ and laryngeal¹¹ arteries, and

¹ White, *Lancet*, London, 1877, vol. ii. p. 789,—sewing-needle.

² Erichsen, *Lancet*, London, 1861, vol. i. p. 416; Watts, *Army Medical Department Reports for 1882*, London, 1884, vol. xxiv. p. 316; Zeman, *Wiener Medicinische Blätter*, 1891, No. 46; *Journal of Laryngology*, 1892, vol. vi. p. 92; Gairdner and Coats, *Glasgow Medical Journal*, 1887, 4th ser., vol. xxviii. p. 62.

³ *La France Médicale*, Paris, 1883, tom. i. p. 17.

⁴ *Dublin Quarterly Journal of the Medical Sciences*, 1855, vol. xix. p. 325.

⁵ *La Clinique des Hôpitaux*, Paris, 1827, tom. i., No. 23.

⁶ Simanovski, *Vrach*, 1890, No. 38, p. 868; *Internationales Centralblatt*, Bd. vi. S. 250.

⁷ Renaudin, *L'Union Médicale et Scientifique du Nord-Est*, Reims, 1880, tom. iv. p. 146.

⁸ Pilatte, *Bulletin de la Société Anatomique de Paris*, 1867, tom. xlii. p. 648.

⁹ *Recueil de Mémoires de Médecine, de Chirurgie et de Pharmacie Militaires*, Paris, 1831, tom. xxxi. p. 310.

¹⁰ Monestier, *Bulletin de la Société Anatomique de Paris*, 1833.

¹¹ Zeman, *op. cit.*

the vena cava,¹ coronary,² and demi-azygos³ veins, have been perforated by foreign bodies from the œsophagus.

6. *Penetration of the Pericardium and Heart*.—Walshe⁴ reports a case in which a knife-blade penetrated the pericardium and caused pericarditis, and also a case where purulent pericarditis resulted from perforation of the pericardium and the entrance of particles of food therein.⁵

Fish-bones often produce serious lesions. Andrews⁶ cites the case of a fish-bone which penetrated the stomach, the diaphragm, the pericardium, the posterior surface of the heart, the interventricular septum, and the right coronary vein. A similar lesion, produced by a fish-bone, is reported by Fitz.⁷

Eve⁸ cites a case in which a lance-shaped fish-bone was found lodged in the œsophagus a quarter of an inch above the cardiac orifice, passing upward and forward through the diaphragm and pericardium, producing a lacerated wound on the posterior surface of the heart.

7. *Penetration of the Pleural Cavity, Lungs, and Bronchi*.—May⁹ reports the case of a child who had swallowed a halfpenny, which ulcerated into the right bronchus, from which it was removed three and a half years after its impaction in the œsophagus. Pneumothorax and empyema¹⁰ are the frequent result of this accident. Shann¹¹ reports the case of a bayonet-shaped bone over an inch and a half long which perforated the œsophagus at the bifurcation of the trachea, made its way into the areolar tissue at the upper part of the lung, and opened into the upper part of the right pleural cavity.

8. *Caries of the Vertebrae*.—Caries of the vertebrae and ulceration of the intervertebral substance may take place to such an extent as to involve the spinal cord. Interesting cases of this kind are reported by Collin,¹² Ogle,¹³ Mondière,¹⁴ Stevens,¹⁵ Fleury, and Mackenzie.

¹ Lovadina, Complément du Dictionnaire des Sciences Médicales, 1818, tom. i. p. 93.

² Andrew, Lancet, 1860, vol. ii. p. 186.

³ Saucerotte, Annales de la Société de Médecine Pratique de Montpellier, 1803, tom. ii. p. 247; Poulet, op. cit., vol. i. p. 92.

⁴ Diseases of the Heart and Great Vessels, 1873, 4th ed., pp. 42, 273.

⁵ Ibid., p. 218.

⁶ Lancet, London, 1860, vol. ii. p. 186.

⁷ American Journal of the Medical Sciences, 1877, vol. lxxiii. p. 17.

⁸ Transactions of the Clinical Society, London, 1880, vol. xiii. p. 174.

⁹ Lancet, London, 1886, vol. i. p. 68.

¹⁰ Busch, op. cit.

¹¹ British Medical Journal, 1873, vol. ii. p. 543.

¹² Recueil de Mémoires de Médecine, de Chirurgie et de Pharmacie Militaires, 1834, tom. xxxvi. p. 242.

¹³ Transactions of the Pathological Society, London, 1852-53, vol. iv. p. 27,—the specimen is in the Museum of St. George's Hospital; Holmes's System of Surgery, American edition, vol. i. p. 726.

¹⁴ Archives Générales de Médecine, Paris, 1830, tom. xxiv. p. 340.

¹⁵ British Medical Journal, 1870, vol. ii. p. 529.

Fleury¹ reports the case of a child twenty-two months old who swallowed a piece of bone while eating soup, which was arrested in the pharynx. She had much cough and hoarseness, with fetor of the breath, but so little dysphagia that she was believed to be suffering from chronic croup. After violent cough, a small bone was expelled two months after the accident; the child soon died, much emaciated. At the autopsy the posterior wall of the pharynx was found to be pierced opposite the anterior part of the third cervical vertebra. The opening was large enough to admit the end of a large sound, and communicated with a large cavity in the bodies of the second, third, and fourth cervical vertebræ, that were carious.

Mackenzie² reports the case of a child who gradually wasted away and died at the end of three months from the time of getting a fish-bone in the throat. On examination, it was found that the fish-bone had passed through the intervertebral substance and wounded the cord.

9. *Rupture of the œsophagus* may take place in consequence of the impaction of a foreign body.

A man,³ aged fifty-six, while eating experienced a sensation of rupture in the chest, with increasing pain during deglutition. Almost immediately afterwards he began to spit blood in large quantities. The following day he vomited an irregular, sharp piece of bone about an inch long. He died the same day. Blood was found in the pleura, pericardium, and posterior mediastinum, and also in the stomach and small intestines. There was a vertical rupture half an inch long in the posterior wall of the œsophagus, and a corresponding rent in the wall of the aorta.

Rupture may be produced during vomiting by a sort of hydraulic pressure brought to bear upon an obstructed œsophagus during the act. Ulceration or laceration of the œsophagus increases the liability of rupture from this cause.

Meyer⁴ reports the case of a man, aged thirty-eight, who had had since childhood a constriction of the œsophagus, who one day felt a piece of sausage lodge at that point. He was in great distress, and after repeated efforts vomited about a cupful of bright red blood. About an hour afterwards emphysema of the face, neck, and the entire chest except the sternum was noticed. Forty hours after the accident the patient died. A gaping wound one and one-fourth inches long and three-eighths of an inch wide was observed three inches above the cardia in the anterior wall of the œsophagus; edges tolerably smooth, and in places sharply defined; mucous membrane extensively destroyed, apparently by ulceration. A large gangrenous cavity extended forward from the perforation into the posterior mediastinum.

¹ Journal de Médecine, Chirurgie, Pharmacie, etc., Paris, 1807, t. xiii. p. 176.

² Diseases of the Throat and Nose, vol. ii. p. 192.

³ Colles, Dublin Quarterly Journal of the Medical Sciences, 1855, vol. xix. p. 325.

⁴ Medizinische Vereinszeitung in Preussen, 1858, Nos. 39, 40, 41; also American Journal of the Medical Sciences, 1877, vol. lxxiii. p. 17.

Fitz¹ reports that three hours before being seen by his physician a man had been partially strangled by a piece of tough, gristly meat lodging in his throat. Every resource of surgery failed to afford him relief, and after an hour of great discomfort he succeeded, by the concentration of all his muscular energy, in ejecting the fragment, which was an inch in length and more than half an inch in diameter. It came from his mouth as from a popgun; he sank back exhausted, and immediately ejected a quantity of clotted and liquid blood. After much suffering, he died, seven and a half days after the accident. At the autopsy a longitudinal rent two inches in length was found in front, to the right, and below the bifurcation of the trachea, extending through all its coats. Its edges were sharply defined, and gave no evidence, microscopically or otherwise, of a pre-existing degenerative or ulcerative process.

DIAGNOSIS.

The diagnosis of foreign bodies in the pharynx and œsophagus is easy when a direct history of the case is obtained and one has the intelligent co-operation of the patient. At other times it is very difficult, particularly when there is an entire absence of any history, as in cases in which foreign bodies find their way into the pharynx and œsophagus during sleep, during a period of semi-unconsciousness, or in a drunken stupor.² And, as in the case of children³ or lunatics,⁴ the patient may also be suffering so much pain, or be so frightened and unmanageable and the dyspnœa so urgent, as to make a careful examination impossible.

1. *Physical Examination.*—The principal methods of physical examination are simple inspection, laryngoscopic examination, palpation, auscultation, the use of sounds and probes, and the œsophagoscope.

If the foreign body is located in the upper part of the pharynx it can usually be detected on simple inspection by placing the patient in a good light and firmly depressing the tongue. If located in the lower part of the pharynx it may be hidden by the glosso-epiglottic or ary-epiglottic fold, and require the aid of the laryngoscope. When no laryngoscope is at hand, the finger⁵ may be employed; but this should be done with the greatest care. The patient should be placed on his side, with the head depressed, so that on dislodging the foreign body it will not fall into the larynx or œsophagus. In exploring with the finger the surgeon should be familiar with the anatomy of the parts, for the epiglottis, the arytenoid cartilages, or the hyoid bone might be mistaken for a foreign body, and, as Cohen observes, care should be exercised not to mistake the tense edge

¹ Fitz, American Journal of the Medical Sciences, 1877, vol. lxxiii. p. 18.

² Loc. cit.

³ Gerster, loc. cit.

⁴ Loc. cit.

⁵ Arnot, Johnson's Review, 1834, vol. xx.

of the pharyngo-epiglottic ligament for a fish-bone, needle, pin, or other substance.¹

Large bodies lodged in the upper portion of the œsophagus may cause a bulging of the neck externally which can be seen on inspection² or detected by gentle manipulation with the hand.³

Clutton⁴ reports the case of a woman who swallowed her tooth-plate, and was able to swallow fluids only, and with great difficulty and pain. Repeated explorations under anæsthesia failed to detect the plate, which the operator was led to believe had passed into the stomach. By external manipulation, however, an abnormal swelling was observed opposite the cricoid cartilage, which proved to be the tooth-plate. Œsophagotomy was performed for its removal.

Substances lodged below the cricoid prominence can be detected only with a sound or probe, which should be used with great care, on account of the danger of perforating the walls of the œsophagus or of crowding the foreign substance more deeply into the tissues.

In some instances a foreign body may be so situated in the œsophagus that it cannot be detected by the most careful exploration, and at the same time the patient may experience pain and discomfort. A most remarkable occurrence of this kind is the case reported by Silver,⁵ already referred to.

Metallic substances that cannot be detected with a gum-elastic bougie may often be located by Langenbeck's sound,⁶ which is provided with a metallic tip, and gives a click on coming in contact with the foreign substance that can be not only heard but also felt by the operator. Metallic substances can, however, sometimes be detected by the ordinary ivory-tipped bougie.⁷ Several bulbs of different sizes should be provided, and firmly attached by screwing them to the whalebone stem. The stem of the bougie should be provided with a scale to determine with precision the distance of the body from the upper incisor teeth. In exploring the œsophagus the sound should, where practicable, be carried through the entire length of the tube into the stomach.

A child, aged five years, who had swallowed a metallic badge about the size of a two-cent piece, was brought to the office of the writer. Fluids and semi-solids were swallowed, but solid substances were rejected. Exploration by means of a gum-elastic catheter failed to reveal anything, but a metallic sound gave forth a click which was distinctly heard. The child was chloroformed and the badge removed with a bristle probang.

¹ Ashhurst's International Encyclopædia of Surgery, New York, 1886, vol. vi. p. 10.

² Germain, *Recueil de Mémoires de Médecine, de Chirurgie et de Pharmacie Militaires*, tom. xlix. p. 198.

³ McKeown,—tooth-plate,—*Lancet*, London, 1878, vol. i. p. 884; Halstead,—fibro-cartilage,—*New York Medical Journal*, 1884, vol. xxxix. p. 226.

⁴ *Lancet*, London, 1888, vol. ii. p. 17.

⁵ *Op. cit.*

⁶ MacKeown, *op. cit.*

⁷ Guy,—penny,—*Boston Medical and Surgical Journal*, 1892, vol. cxxvi. p. 332.

A case similar to this is reported by MacLean.¹

Duplay's resonator, perfected by Collins (Fig. 33), for detecting metallic bodies, consists of a metallic catheter fitted into a hollow metallic cylinder, which serves the purpose of a sound-box. On connecting this box with the ear by means of a piece of rubber tubing, the sound produced by the slightest contact of the tip of the instrument with a metallic substance is communicated, by vibration, to the ear. In using this instrument it is important to cover the stem with a piece of rubber tubing, that the contact of the metal with the teeth of the patient may not lead to the impression that a metallic foreign body has been discovered in the œsophagus.

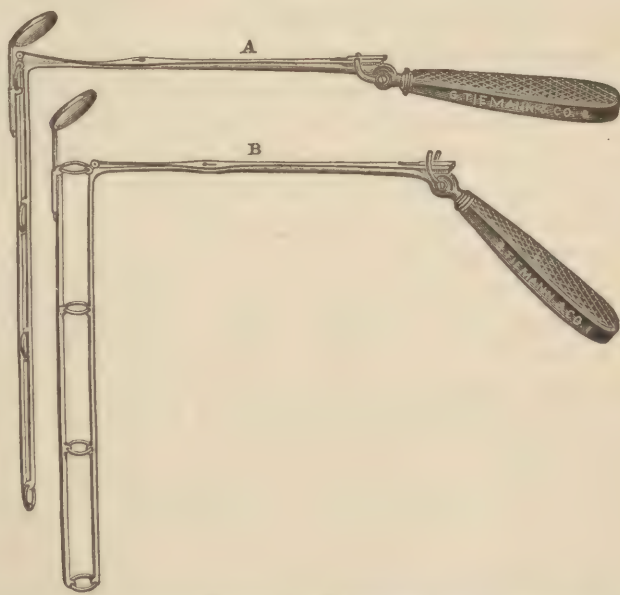
FIG. 33.



Duplay's resonator.

Sounds and bougies² sometimes fail to detect foreign bodies, on account of their size or position³ or their being covered with mucus or by folds of the mucous membrane.⁴ In such cases the œsophagoscope devised by Mackenzie is of great service. Fig. 34 represents this instrument,—*A*, closed for insertion; *B*,

FIG. 34.



Mackenzie's œsophagoscope.—*A*, closed for insertion; *B*, opened after introduction.

opened after introduction,—with the mirror at the top for the purpose both

¹ Penny in œsophagus of an infant sixteen months old,—New York Medical Record, 1884, vol. xxvi. p. 282.

² Legouest,—coin.—case cited by Michel, Dictionnaire Encyclopédique des Sciences Médicales, art. "Œsophage," p. 515; Cohen, Ashhurst's Surgery, p. 11; Silver, op. cit.

³ Marston, British Medical Journal, 1882 vol. i. p. 305.

⁴ Lesbros, Journal of the American Medical Association, 1883, vol. i. p. 621.

of reflecting light into the œsophagus and of revealing its interior. By this means Mackenzie¹ detected a flat lamella of bone, four millimetres square, lodged in the anterior wall of the œsophagus, about two inches below the cricoid cartilage, which could not be located in any other manner.

The apparatus for the electric illumination of the stomach by Mikulicz's² electric gastroscope, as improved by Leiter, is also of special service for detecting and removing foreign bodies from the œsophagus. Von Hacker³ reports a case in which he detected a bone in the œsophagus by this means.

Auscultation of the œsophagus, as proposed by Hamburger⁴ and elaborated by Mackenzie,⁵ Elsberg,⁶ and Allbutt,⁷ may be of especial service in determining the location of a foreign body obstructing the œsophagus.

Exploration of the œsophagus is ordinarily made with the patient in a sitting posture, the head thrown well back so as to bring the pharynx and mouth on a direct line with the œsophagus. The tongue should be drawn forward and held with a napkin, and the instrument, well oiled and warmed, passed gently along the posterior wall of the pharynx into the œsophagus. When anæsthesia is necessary, as it frequently is in children and when the œsophagoscope is used, the patient should be in a recumbent position, with the head held below the level of the shoulders, so as to bring the pharynx and œsophagus on the same plane.

2. *Differential Diagnosis.*—Foreign bodies lodged in the pharynx and œsophagus should be carefully differentiated from those in the air-passages. Substances lodged in the pharynx so large as to occlude the larynx should be differentiated from bodies in the larynx itself. Foreign bodies lodged in the œsophagus causing dyspnoea from pressure on the trachea should be differentiated from those in the latter organ.⁸

Cheever⁹ reports the case of a man, forty-four years old, who swallowed a fish-bone. Three days after the accident he was in great distress. The symptoms were not merely those of a foreign substance in the alimentary canal, but also hoarseness, laryngeal spasm, and rapid respiration, symptoms indicating a foreign body in the air-passages. (Œsophagotomy was performed, and a bone was discovered behind and between the arytenoid cartilages.

The dyspnoea resulting from a foreign body in the œsophagus may also simulate croup, as in the following case reported by Paterson:¹⁰

¹ Diseases of the Throat and Nose, vol. ii. p. 193.

² Wiener Medizinische Presse, 1881, Nos. 45 and 52.

³ Imperial Royal Society of Physicians, Vienna, 1889.

⁴ Medizinische Jahrbücher, Wien, 1868, Bd. xv. S. 133; also, Klinik der Œsophagus-krankheiten, Erlangen, 1871.

⁵ Lancet, London, May 30, 1874.

⁶ Auscultation of the Œsophagus, Philadelphia, 1875.

⁷ British Medical Journal, 1875, vol. ii. p. 420.

⁸ Poulet, op. cit., vol. i. p. 103.

⁹ Boston Medical and Surgical Journal, 1882, vol. cvi. p. 265.

¹⁰ Edinburgh Medical and Surgical Journal, 1848, vol. lxxi. p. 125.

A girl, five years of age, swallowed a toy tin cup. There was no pain or difficulty in swallowing, and nothing more was thought of the accident. Four months afterwards she was seized with a severe attack of croup. The œsophagus was finally explored, and an obstruction found. She died twenty-six days afterwards. At the autopsy the cup was found fixed in an opening between the œsophagus and the trachea, partly projecting into the latter.

Cases are reported by Dupuy,¹ Ferrus,² Broca,³ and others where death occurred from asphyxia caused by the lodgement of a foreign body in the œsophagus.

PROGNOSIS.

The prognosis in all cases of foreign bodies in the pharynx and œsophagus is uncertain, for the reason that they may sojourn for a long time without serious disturbance to the patient. At other times a foreign body, even when soon removed, may have caused so much injury as to result in death. Generally the prognosis is favorable in all cases in which the foreign body is speedily and harmlessly removed, and correspondingly unfavorable according as the foreign body is sharp and angular and so deeply embedded as to cause laceration of the tissues on removal.⁴ In such cases the danger is greatest when the foreign body is located below the manubrium sterni. If above the sternum, it is accessible through an opening in the neck and more easily removed.

Taking the cases in the aggregate, the following statistics give the average dangers attending the accident and the relative success attending treatment. In eighty-six cases in which the foreign body was removed through the natural passages by expulsion, extraction, or propulsion, there were seventy-nine recoveries. In sixteen cases the foreign body was expelled spontaneously. In forty-one cases in which they were removed by œsophagotomy there were twenty-six recoveries.

These statistics, however, may be said to exaggerate the dangers, for the reason that only the most important cases which present grave aspects are reported; the minor cases, in which the substance became loosened and was expelled spontaneously, go unnoticed. Notwithstanding this, and the fact that in some cases foreign bodies remain a long time in the œsophagus without producing serious disturbance, the lodgement of substances in the œsophagus is liable to excite irritation and inflammation, and is always to be regarded as a serious accident. This is shown by the fact that such

¹ Bulletin de la Société Anatomique de Paris, 1873, tom. xlviii. p. 81.

² Gazette des Hôpitaux, Paris, 1830-31, tom. iv. p. 120.

³ Bulletin de la Société de Chirurgie de Paris, 1861, 1862, 2e sér., tom. ii. p. 698.

⁴ Adelman gives a collection of three hundred and fourteen cases of foreign bodies in the œsophagus. Two hundred and thirty had rough, cutting surfaces. Sixty-eight cases ended fatally, in thirty-seven of which the foreign body was a bone splinter. Prager Vierteljahrsschrift für die praktische Heilkunde, 1867, 24. Jahrgang, Bd. iv. S. 66.

simple substances as a bead,¹ a glass pearl,² a button,³ the heart of a fowl,⁴ and a piece of ham⁵ have caused death.

The prognosis is sometimes largely modified by the skill and judgment of the surgeon. This is illustrated in many cases that might be cited where the œsophagus has been unnecessarily lacerated by dragging out or pushing into the stomach substances which might have been carefully and harmlessly extracted, or removed by external œsophagotomy.

TREATMENT.

In the treatment of foreign bodies lodged in the pharynx and œsophagus it frequently happens that attention must be directed to the relief of impending asphyxia by prophylactic tracheotomy,⁶ before the removal of the substance is possible.

The general methods of removal are expulsion, extraction, propulsion, and incision.

1. *Expulsion*.—The natural means by which foreign bodies are expelled are coughing, vomiting, inversion, and artificial digestion.

Cough, which is nearly always present, is effective in expelling a foreign body only when located in the pharynx and at the entrance of the œsophagus. Violent cough often excites vomiting, and by these combined influences foreign bodies are sometimes expelled from the lower part of the œsophagus. Baraffio⁷ relates the case of a large-sized spoon thus expelled. Foreign bodies loosened by ulceration⁸ may be expelled by the act of vomiting alone.

Emesis may be produced by tickling the fauces with the finger or a feather, by swallowing quantities of water or oil, or by the administration of ordinary emetics. Weinlechner⁹ reports a case in which a girl eighteen years old swallowed a tooth-plate with five teeth attached. Oil was given until she vomited it up.

When emetics cannot be swallowed, or a catheter passed through which they can be injected,¹⁰ they may be administered subcutaneously. The best drug for this purpose is hydrochlorate of apomorphine, one-twenty-fifth to one-tenth of a grain. This solution, as observed by Mackenzie,¹¹ is so

¹ Billroth, *Clinical Surgery*, London, 1881, p. 132.

² Menzel, *Archiv für Klinische Chirurgie*, Berlin, 1872, Bd. xiii. S. 678.

³ Gerster, *New York Medical Journal*, 1886, vol. xliii. p. 558.

⁴ Denton, *American Journal of the Medical Sciences*, 1829–30. vol. v. p. 544.

⁵ Ashhurst, *New York Medical Journal*, 1875, vol. xxi. p. 273.

⁶ Usiglio, *Gazzetta degli Ospitali*, No. 72, 1885,—piece of meat.

⁷ *Lancet*, London, 1873, p. 616 (American reprint).

⁸ Thomas Smith, *Lancet*, London, 1879, vol. ii. p. 76,—tooth-plate; Evans, *ibid.*, p. 75,—tooth-plate retained two years and eight days.

⁹ *Wiener Medizinische Wochenschrift*, 1880, Bd. xxx. S. 741.

¹⁰ Habel, *Langenbeck's Archives*, 1862; cited by Poulet, vol. i. p. 106.

¹¹ *Diseases of the Throat and Nose*, vol. ii. p. 194.

unstable that it should always be freshly prepared for hypodermatic use. The intravenous injection of tartar emetic¹ and enemas of tobacco have also been employed for this purpose. Hévin² reports that Mignot successfully removed by this means a piece of sheep's lung which had become lodged in the œsophagus.

Vomiting is of service in the expulsion of foreign substances from the pharynx, and of round³ and smooth bodies held by spasmodic contraction of the œsophagus, the emesis causing, in such cases, relaxation of the spasm. In cases of sharp or angular bodies which may penetrate the walls of the œsophagus, emesis greatly increases the danger of perforation. When the foreign body is large, or so firmly impacted as completely to obstruct the passage, it is not only inadvisable, but dangerous, for the reason that the avenue for the forcible expulsion of the contents of the stomach is cut off, and the force may be sufficient to rupture the œsophagus, as has occurred in cases⁴ already referred to.

Treatment by position is of no avail when the foreign body is lodged in the œsophagus. Mackenzie⁵ refers to a case reported by Hévin where a patient had swallowed a knife, and was, in accordance with his own request, several times hung up by the heels, in the hope that the knife would fall out by its own weight. This treatment was without good result, and the knife was finally extracted from the lower end of the œsophagus by gastrotomy.

When alimentary substances, such as pieces of meat, are impacted in the œsophagus, the plan of artificial digestion by means of pepsin⁶ may be tried. This is valuable when the substance is lodged above a stricture. Bobbitt⁷ reports a case in which a piece of meat lodged above a stricture of the œsophagus was digested by a trypsin mixture and the patient relieved; and Balch⁸ reports a similar case in which the meat was digested by a solution of hydrochloric acid and pepsin.

2. *Extraction.*—The different instruments by means of which foreign bodies may be extracted from the pharynx and œsophagus were divided by Hévin into—1, forceps; 2, hooks; 3, rings; 4, fixed sponges. Poulet, however, classifies them in a more natural order, as—(a) prehensors, those that draw the foreign body out without going beyond it; (b) conductors, such as go beyond the foreign body and draw it upward with them; (c) dilators, those which pass beyond the foreign body and distend the canal while bringing out the substance.

¹ Kohler, Bibliothèque du Nord, tom. i.; Poulet, op. cit., vol. i. p. 105.

² Poulet, op. cit., vol. i. p. 105.

³ Jones, Lancet, London, 1861, vol. i. p. 188.

⁴ Loc. cit., ante, p. 550.

⁵ Diseases of the Throat and Nose, vol. ii. p. 195.

⁶ Deutsche Klinik, 1861, p. 109.

⁷ North Carolina Medical Journal, 1887, vol. xx. p. 202.

⁸ New York Medical Journal, 1875, vol. xxi. p. 272.

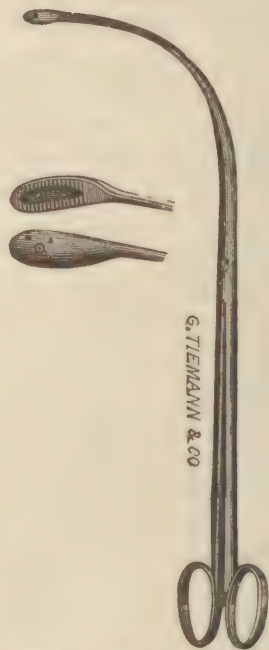
(a) *Prehensors*.—Among the most serviceable of these for use in the pharynx are Fauvel's forceps. Those opening antero-posteriorly are shown in Fig. 35, and those opening laterally in Fig. 36. The most useful

FIG. 35.



Fauvel's forceps, antero-posterior view.

FIG. 36.



Fauvel's forceps, lateral view.

oesophageal forceps are Moe's gum-elastic flexible forceps (Fig. 37), and Dawson's flexible spiral forceps (Fig. 38). Mathieu's alligator forceps (Fig. 39) are often of special service when a stiff-shanked instrument is preferred; also, Bond's forceps (Fig. 40) as modified by the writer. The modification of these forceps consists in having the blades bevelled, so that the grasping surface is very narrow, thereby lessening the danger of grasping the mucous membrane, and at the same time permitting long, slender substances, like needles, pins, or fish-bones, to turn in the blades and lie longitudinally to the axis of the canal during extraction.

(b) *Conductors*.—Among these may be mentioned Petit's hook (Fig.

FIG. 37.



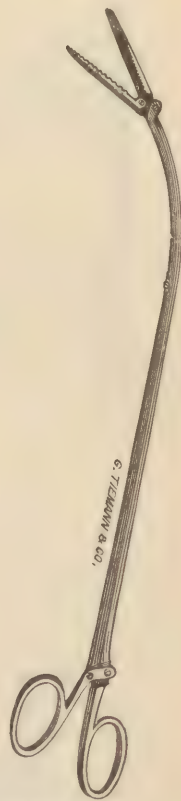
Moe's gum-elastic forceps.

FIG. 38.



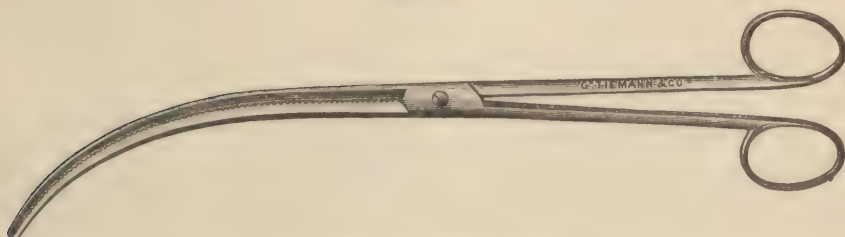
Dawson's flexible forceps.

FIG. 39.



Mathieu's alligator forceps.

FIG. 40.



Bond's forceps (modified by author).

41), Graefe's basket (Fig. 42) and ring coin-catcher (Fig. 43), and the writer's flexible spiral lever extractor (Fig. 44). The latter instrument

FIG. 41.



Petit's hook.

FIG. 42.



Graefe's basket.

FIG. 43.



Graefe's ring coin-catcher.

FIG. 44.



Roe's flexible spiral lever extractor.—a, lever opened after having been passed beyond the foreign body; b, closed during introduction or after foreign body is grasped.

operates on the plan of Shaeffer's uterine curette, and has several advantages over Graefe's basket. It is more readily passed beyond the object, which when grasped is held firmly, and the closed blade will not catch under the cricoid prominence.

Many ringed instruments are also used. In a case in which a tooth-plate was impacted in the œsophagus, Dearden,¹ having no forceps long enough to extract it, devised the plan of attaching about twenty nooses of horse-hair to a sponge probang. The plate readily caught in these, but its edges were so sharp, and it was so firmly impacted, that they were repeatedly cut through. He then fastened loops of steel wire in the same manner, which brought up the plate, inflicting very slight injury to the walls of the œsophagus.

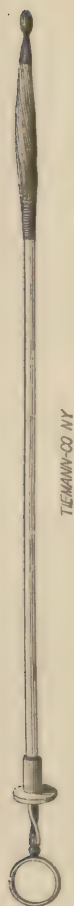
(c) *Dilators*.—Among the first instruments used on the principle of dilators were sponges attached to whalebone handles. These are compressed into small compass by being wound with silk ribbon, which is

¹ Lancet, London, 1869, vol. ii. p. 540.

withdrawn after passing the foreign body, when the sponge is allowed to expand. On the withdrawal of the sponge the substance is readily removed with it. This is an excellent means for removing pins, needles, pieces of bone, and other sharp substances; for the reason that they readily pass into the sponge, and are thus prevented from injuring the œsophagus on withdrawal.

Other instruments in common use are Gross's bristle probang (Fig. 45) and Sanford's bristle probang (Fig. 46). The writer has devised

FIG. 45.



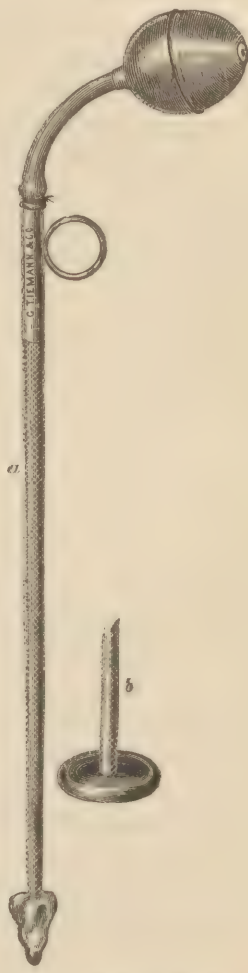
Gross's bristle probang.

FIG. 46.



Sanford's probang.

FIG. 47.



Roe's dilating extractor.

a rubber dilating extractor. This is introduced with the dilator collapsed (Fig. 47, *a*), and when beyond the foreign body it is inflated by a rubber bulb at the proximal end of the stem (Fig. 47, *b*). When inflated the bulb is flattened and somewhat cup-shaped, and readily catches the foreign body

on its withdrawal. Water can be used instead of air. The instrument may also be used for propulsion.¹

In the removal of large or round bodies, alimentary substances, coins, and similar objects from the pharynx and Œsophagus, the finger is often serviceable. But its use is unadvisable in cases of sharp, penetrating substances, as pins, needles, fish-bones, angular bodies, jagged bones, and the like.²

Laryngoscopic illumination of the pharynx is nearly always necessary for the removal of substances from this region. Catti³ says it should precede all efforts at removal.

In cases where both ends of long bodies, such as needles, pins, and bones, are impacted in the tissues, the blunt end should first be liberated, thus permitting extraction without laceration.

Schroetter⁴ advises the operator to grasp the needle at its point, in order to prevent its becoming impacted more deeply and penetrating important vessels. In certain cases this may be preferable, but ordinarily the blunt end can be much more easily freed, and it is rare that the slight penetration of the point is a disadvantage so long as the tissues are not lacerated.

The most troublesome substances for removal from the pharynx are slender fish-bones and pieces of bristles and the like, which may be so embedded in a fold of mucous membrane, or so penetrate a crypt of the tonsil, as to be scarcely visible. In many cases these can be felt with the finger when they cannot be seen.

In the extraction of foreign bodies from the Œsophagus the patient should be seated upright in a chair, the head thrown backward and firmly held by an assistant. The surgeon, standing in front of the patient, grasps his tongue with the left hand and draws it forward, which opens the entrance of the Œsophagus by raising and drawing forward the cricoid body. Some advise holding the tongue down with a tongue-depressor; but in so doing there is some danger of forcing the epiglottis into the larynx on the introduction of the instrument. Before introducing an instrument it is advisable to direct the patient to swallow some oil, or to pour some into his Œsophagus, as suggested by Langenbeck.⁵ The depth of the body from the upper incisor teeth should also be ascertained by means of a graduated sound and indicated on the stem of the instrument. By this means the operator can avoid displacing the foreign body. The forceps, warmed to prevent spasm, and well oiled, should be introduced with the blades closed

¹ A great many other instruments have been devised for the removal of foreign bodies from the pharynx and Œsophagus, and will be found described in the different catalogues of surgical instrument-makers.

² Markoe, *New York Medical Journal*, 1886, vol. xliii. p. 481.

³ *Wiener Medizinische Blätter*, 1878, Bd. i., No. 25, S. 595.

⁴ *Monatsschrift für Ohrenheilkunde*, 1882, Bd. xvi., No. 2, S. 25.

⁵ *Berliner Klinische Wochenschrift*, 1877, Bd. xiv. S. 741.

until the body is reached, and when it is grasped no great amount of force should be applied.

When repeated trials are necessary, especial care should be taken not to excite undue irritation of the œsophagus. Bruising the mucous membrane by the bite of the forceps, or eroding it by the use of the horse-hair or other probang, or of Græfe's basket, should be guarded against, for in some instances the result of such injury has been fatal. In Demarquay's case¹ the use of Græfe's basket caused emphysema, tumefaction, and fever, and death resulted six months later from marasmus.

The removal of foreign bodies from the œsophagus is in many cases a very simple procedure, but complications sometimes arise which tax the ingenuity of the surgeon. Baud² and Leroy³ were the first to devise the removal of fish-hooks from the œsophagus by drilling leaden balls and passing them down on the line, the weight of which is sufficient to disengage the hook, and the size to cover the point on its withdrawal. Laurent⁴ for the same purpose used a large-sized, hollow bougie. Professor Syme⁵ relates the case of a boy who had swallowed a three-pronged fish-hook attached to a strong wire. The surgeon drilled an ivory ball of appropriate size and passed this along the wire. A little concussion forced the barbs into small holes drilled into the ball, and the hook was successfully withdrawn. Several interesting cases of the removal of fish-hooks are related by Mackenzie.⁶ Torrance⁷ cites a case in which the shoulder-blade of a rabbit became so lodged in the œsophagus that he was unable to grasp it with forceps. He then dropped in some lead pellets attached to a piece of wire. These were so entangled below the bone, by moving them up and down, that when withdrawn the bone was extracted.

Care should be exercised not to allow the instrument for extraction to be broken or impacted⁸ in the œsophagus with the foreign body.

One of the most complicated cases of this kind is reported⁹ by Adelmann, in which a man swallowed a piece of mutton containing a bone. Attempts at extraction with forceps, sponge probang, and Græfe's coin-catcher were made. This last instrument passed below the foreign body, but became so tightly wedged in that it could not be withdrawn, and the patient remained in this condition two days. The coin-catcher was then loosened by means of a gum-elastic catheter which was threaded over it, and the foreign body was pushed down into the stomach.

¹ Créquy, *Gazette Hebdomadaire*, 1861; Poulet, *op. cit.*, vol. i. p. 118.

² *Revue de Médecine et de Chirurgie*, Paris, 1847, tom. ii. p. 110.

³ *Ibid.*, 1848, tom. iii. p. 44.

⁴ *Lancet*, London, 1882, vol. ii. p. 745.

⁵ *Ibid.*, 1884, vol. i. p. 526.

⁶ *Diseases of the Throat and Nose*, p. 526.

⁷ *British Medical Journal*, 1875, vol. i. p. 810.

⁸ Korlovski, *Meditsinskii Sbornik*, Tiflis, 1869, vol. ii. pt. 4, 1-16; Holmes, *Medical Times and Gazette*, January 13, 1883.

⁹ *Prager Vierteljahrsschrift für Praktische Heilkunde*, Bd. xevi. S. 66; Mackenzie, *op. cit.*, vol. ii. p. 188.

Selby¹ removed a token, a small coin, from the œsophagus of a child two and a half years old by an ingenious coin-catcher which he improvised for the occasion. He doubled a piece of stiff piano-wire and passed it through a gum-elastic catheter, leaving a heart-shaped loop at the end, which he turned up at an angle of twenty degrees. The other end of the wire was secured to the catheter. Passing this into the œsophagus, he had no trouble in engaging the coin and extracting it.

Reeves² devised a simple method of passing bent wire hooks enclosed in a soft-rubber catheter into the œsophagus. The hooks are liberated after being passed beyond the foreign body.

Créquy³ recommends tangling up a skein of thread and tying it in the centre with a strong thread forty or fifty centimetres long and covering the mass with some agreeable confection and letting the patient swallow it. As soon as it is supposed to have passed the foreign body it is drawn out. He has succeeded with this device in several instances.

In withdrawing the foreign body care should be exercised to prevent its slipping from the grasp of the instrument and falling into the larynx⁴ before it is removed from the mouth. In cases where the foreign body has produced much irritation on its entrance, it is sometimes necessary for the patient to suck ice and resort to antiphlogistic measures, and to postpone removal until the spasmodic disturbance has subsided. These measures are also often called for after removal,⁵ for relief from the pain and irritation occasioned by the foreign body or by its extraction.

In some cases where the irritability is very great, cocaine may be of service, sprayed into the lower pharynx and injected, in a very weak solution, into the œsophagus. In adults anaesthesia is very rarely required, but in children it is often necessary. When practicable, extraction should be done without it, for the intelligent co-operation of the patient is of great assistance. In cases where the foreign body is so firmly impacted that it cannot be withdrawn, the relaxing effect of general anaesthesia⁶ is of material assistance.

3. *Propulsion*.—The method of removing foreign bodies from the œsophagus by means of propulsion is admissible only in certain cases in which an alimentary or digestible substance has simply become wedged in the œsophagus and by being dislodged may readily be swallowed, as in

¹ British Medical Journal, 1890, vol. ii. p. 1362. Instrument illustrated.

² Melbourne Medical Record, cited in Medical and Surgical Reporter, 1877, vol. xxvii. p. 312.

³ Annual of the Universal Medical Sciences, 1889, vol. iv. G p. 36.

⁴ Deaver, Medical News, Philadelphia, 1890, vol. lvi. p. 475; Sée, Bulletin et Mémoires de la Société de Chirurgie de Paris, 1875, N. S., tom. i. p. 271.

⁵ Thompson, British Medical Journal, 1885, vol. i. p. 430.

⁶ Lediard,—impacted tooth-plate dislodged,—Lancet, London, 1885, vol. i. p. 990; Abbe,—tooth-plate easily removed after anaesthesia which could not be dislodged before,—New York Medical Journal, 1886, vol. xliii. p. 503.

the cases related by Dupuytren¹ and Langenbeck.² An interesting case of removal by manipulation and propulsion is reported by Walker.³ He succeeded in working a coin up from the upper portion of the œsophagus with his thumb and finger. In every instance, before attempting to employ propulsion an exact knowledge of the nature and location of the foreign substance should be obtained; for substances in the pharynx that could readily be extracted might by this means be dislodged and become impacted in the œsophagus, or fall into the larynx or trachea.⁴

In the case of a soft substance, like a cooked potato or a piece of meat, it may be crushed, flattened, or broken up so as to pass readily into the stomach;⁵ whereas if it is a sharp piece of bone, a set of false teeth, or other angular, penetrating substance, such manipulation may be the direct means of perforating the œsophagus.⁶

In some cases the propulsion of a foreign substance may be greatly assisted by the peristaltic action of the œsophagus caused by drinking water or oil. The most common instrument used for propelling substances into the stomach is the sponge probang; but when no instrument is at hand the stiff stem of some plant, as that of the leek, or some similar substance, may be used. Water may also be injected into the œsophagus through an œsophageal catheter sufficiently large to fill the canal.

In one instance Gautier⁷ successfully used the air-ball pessary of Gariel for propelling a foreign body into the stomach. The pessary was introduced down the œsophagus to the foreign substance and then inflated with air. Bénéque⁸ has used a sac of gold-beater's skin, and Robertson⁹ a condom, for the same purpose.

Cohen¹⁰ suggests that the foreign body may sometimes be broken up or crushed so that it will readily pass onward.

A very ingenious method of causing propulsion was resorted to by Sowers, of Warrenton, Virginia.¹¹ A man got a piece of gristly beef in his œsophagus and was unable to swallow either fluids or solids. Sowers first tried to provoke emesis by tickling the fauces with the finger, which failed. He then tried electricity, turning on four or five cells of the faradic current. One electrode was placed on the stomach, and the other as nearly as possible over the seat of the obstruction. The current was several times

¹ Quoted by Luton, *Nouveau Dictionnaire de Médecine et de Chirurgie*, Paris, 1877, tom. xxiv. p. 356.

² Mackenzie on Diseases of the Throat and Nose, vol. ii. p. 195.

³ *Lancet*, London, 1876, vol. ii. p. 670; Polikier, *Revue Mensuelle des Maladies de l'Enfance*, Paris, 1891, tom. ix. p. 24.

⁴ Poulet, *op. cit.*, vol. ii. p. 19.

⁵ Trendelenburg, *Langenbeck's Archiv*, Bd. xiv. S. 635.

⁶ Baratoux, *La Pratique Médicale*, Paris, January 18, 1891.

⁷ *Bulletin de la Société de Médecine*, t. viii. p. 386.

⁸ *New York Medical Record*, 1883, vol. xxiii. p. 55.

⁹ Ashhurst's *International Encyclopædia of Surgery*, vol. vi. p. 17.

¹⁰ Reported personally to the author.

¹¹ *Ibid.*

interrupted to produce more powerful spasmodic efforts, and in about a minute the obstruction was removed.

Notwithstanding the fact that large and irregular bodies, like tooth-plates,¹ safety-pins,² forks,³ pieces of glass,⁴ bones, and live fish,⁵ have passed the œsophagus and been voided without harm, the propulsion of such substances into the stomach is a dangerous procedure, as emphasized by Koenig.⁶ Not only may the œsophagus be lacerated thereby, but the substance may cause serious disturbance to the abdominal organs, as in a case cited by Lea⁷ in which a fatal enteritis was excited by a copper coin which had been pushed into the stomach. Koenig, however, says that when the foreign body is located in the lower end of the œsophagus and cannot be extracted, it is less dangerous to push it into the stomach than to allow it to remain.

4. *Incision*.—When foreign bodies have become so firmly impacted in the pharynx or the upper portion of the œsophagus that they cannot be removed *per vias naturales*, the operation of pharyngotomy or œsophagotomy should be resorted to without delay.

The methods by which the pharynx is reached by incision through the neck are sub-hyoidean and lateral pharyngotomy, the former method being the one usually employed.

This operation was first performed by Prat⁸ in 1851 for the removal of a fibrous tumor from the larynx, but Lefferts,⁹ in 1870, was the first to perform it for the removal of a foreign body. He reports it as "the operation of sub-hyoidean laryngotomy, or more properly, perhaps, sub-hyoidean pharyngotomy."¹⁰ Since then it has been performed several times for the same purpose. Subbotie¹¹ reports a case where he removed a pin from the left pyriform sinus, in a man twenty-seven years old, by this means. Heryng¹² and Jawdyski report a case of sub-hyoidean pharyngotomy in a man thirty-six years of age for the removal of a bone embedded for three weeks in the posterior wall of the pharynx which had ulcerated into the body of the fourth cervical vertebra. In each case the patient recovered.

Franks¹³ performed this operation on a lunatic aged thirty who had

¹ Davies, *Lancet*, London, 1882, vol. i. p. 566; Cant, *ibid.*, 1886, vol. ii. p. 153; Palmer, *ibid.*, 1881, vol. ii. p. 997.

² Packard, *Philadelphia Medical Times*, April 15, 1872, p. 26.

³ Adelman, *New York Medical Record*, 1872, vol. vii. p. 236.

⁴ Poulet, *op. cit.*, vol. i. p. 64.

⁵ Stewart, *Lancet*, London, 1869, vol. ii. p. 434.

⁶ *Lehrbuch der Speciellen Chirurgie*, III. Aufl., Bd. i. S. 108.

⁷ St. George's Hospital Reports, 1869, p. 219.

⁸ *Gazette des Hôpitaux*, Paris, 1859, No. 103.

⁹ *Medical Record*, New York, 1874, vol. ix. p. 641.

¹⁰ See p. 527.

¹¹ *Allgemeine Wiener Medizinische Zeitung*, 1886, Bd. xxxi. S. 112.

¹² *Gazeta Lekarska*, Warszawa, 1890, 2d ser., vol. x. p. 349.

¹³ *Jahres-Bericht über die Chirurgische Klinik der Universität Greifswald*, 1890, p. 30.

swallowed a spoon and a fragment of porcelain with suicidal intent. Five hours afterwards the spoon was removed, but not the porcelain. Tracheotomy was required. Sub-hyoidean pharyngotomy was done at the same time, and the porcelain removed from the lower portion of the pharynx. Death occurred suddenly the next morning. Autopsy revealed a retro-pharyngeal abscess.

Hoffmann¹ cites a similar case. A lunatic crowded broken pieces of pottery into his throat which could not be removed *per vias naturales*. Sub-hyoidean pharyngotomy was performed and the fragments were removed. The patient died.

Wheeler² reports a case in which he successfully removed a threaded needle from the pharynx by lateral pharyngotomy. The eye of the needle was embedded in the left palato-pharyngeal muscle, and the point in the left thyroid cartilage.

Barton,³ of Dublin, reports an exceedingly interesting case of lateral pharyngotomy successfully performed on a child for the removal of a small steel roller that had been impacted for three months in the lower portion of the pharynx, on the left side, without producing urgent symptoms.

M. H. Richardson⁴ reports a most interesting case in which he successfully removed by gastrotomy a large tooth-plate which had been impacted for a year in the lower part of the œsophagus and had resisted all attempts at removal.

The œsophagus being much less accessible by ordinary means than the pharynx, œsophagotomy is more often required than pharyngotomy, as shown by a record of one hundred and forty-four cases of the former against only eight of the latter.

Georg Fischer in his admirable article on "Œsophagotomy for Foreign Bodies in the Œsophagus"⁵ has given a detailed report of one hundred and eight cases. From this table we must deduct one case of pharyngotomy reported by Barton,—which was probably included by accident in his list,—also one case of œsophagotomy in which gastrotomy was subsequently performed with fatal issue, thus leaving one hundred and six cases of œsophagotomy. Of these there were seventy-eight recoveries and twenty-eight deaths.

Since Fischer's report we have a record of fifty operations, as follows: Abbe,⁶ Balujew⁷ (two cases), Begin,⁸ Bereskin⁹ (two cases), Butlin,¹⁰ Ca-

¹ Deutsche Medizinische Wochenschrift, 1889, No. 19.

² Medical Press and Circular, London, 1875, N. S., vol. xix. p. 312.

³ Annals of Surgery, St. Louis, 1887, vol. vi. p. 22.

⁴ Boston Medical and Surgical Journal, 1886, vol. cxv. p. 567.

⁵ Deutsche Zeitschrift für Chirurgie, Leipzig, 1888-89, Bd. xxix. Ss. 97-111.

⁶ New York Medical Journal, 1892, vol. lv. p. 319.

⁷ Meditsinskoe Obozraenie, Moskva, No. 15, 1888; cited in Internationales Centralblatt, 1888-89, Bd. v. S. 528.

⁸ American Journal of the Medical Sciences, vol. xiii. p. 252.

⁹ Meditsinskoe Obozraenie, Moskva, 1891, vol. xxxv. p. 435.

¹⁰ Lancet, London, 1884, vol. i. p. 526.

hier,¹ Clutton,² Cordemans,³ Deaver,⁴ Desvernine,⁵ Egeberg,⁶ Félizet,⁷ Free-land,⁸ Frew,⁹ Furner,¹⁰ Gay¹¹ (two cases), Giommi,¹² Gross,¹³ Grubert,¹⁴ Gus-senbauer,¹⁵ Halsted,¹⁶ Jalaguier,¹⁷ Krönlein,¹⁸ Markoe,¹⁹ McArdle,²⁰ McFar-lane,²¹ Pye,²² Ramon de la Sota y Lastra²³ (two cases), Richet²⁴ (three cases), Roersch²⁵ (two cases), Sarycheff,²⁶ Segond,²⁷ Sklifosovski²⁸ (three cases), Southam²⁹ (two cases), Stroem,³⁰ Terrillon,³¹ Tobin,³² von Wahl,³³ Wight,³⁴ and Wright,³⁵ with the result of thirty-one recoveries.

¹ *Revue Internationale de Rhinologie, Otologie et Laryngologie*, May 10, 1893, tom. iii. p. 100.

² *Lancet*, London, 1888, vol. ii. p. 17.

³ *Journal de Médecine, de Chirurgie et de Pharmacologie*, Bruxelles, 1892, pp. 891-896.

⁴ *Medical News*, Philadelphia, 1890, vol. lvi. p. 475.

⁵ *Crónica Médico-Quirúrgica de la Habana*, 1888, tom. xiv. p. 319.

⁶ *Tidsskrift for Praktisk Medicin*, Christiania, April 1, 1887.

⁷ *Revue Internationale de Rhinologie, Otologie et Laryngologie*, May 10, 1893, tom. iii. p. 100.

⁸ *Medical Record*, New York, 1891, vol. xl. p. 511.

⁹ *Annals of Surgery*, 1888, vol. vii. p. 187.

¹⁰ *Lancet*, London, 1891, vol. i. p. 979.

¹¹ *Boston Medical and Surgical Journal*, 1892, vol. cxxvi. p. 332; second case, *ibid.*

¹² *Il Raccogliatore Medico*, Forli, 1887, 5th ser., vol. iv. p. 492.

¹³ *La Semaine Médicale*, Paris, 1891, tom. xi. p. 45.

¹⁴ *St. Petersburg Medizinsche Wochenschrift*, 1890, N. F., Bd. vii. S. 393.

¹⁵ *Deutsche Medizinsche Wochenschrift*, Berlin, 1876, Bd. ii. S. 20.

¹⁶ *New York Medical Journal*, 1884, vol. xxxix. p. 226.

¹⁷ *Revue Internationale de Rhinologie, Otologie et Laryngologie*, May 10, 1893, tom. iii. p. 100.

¹⁸ *Correspondenz-Blatt für Schweizer Aerzte*, Basel, 1891, Bd. xxi. S. 503.

¹⁹ *New York Medical Journal*, 1886, vol. xliii. p. 481.

²⁰ *Dublin Journal of Medical Science*, 1888, 3d ser., vol. lxxxv. p. 310.

²¹ *Canadian Practitioner*, January, 1890.

²² *British Medical Journal*, 1889, vol. i. p. 528.

²³ *Revue Mensuelle de Laryngologie, d'Otologie et de Rhinologie*, Bordeaux, Paris, 1887, tom. vii. p. 505,—second case; *Revista Médica de Sevilla*, 1888, tom. xii. p. 5.

²⁴ *La France Médicale*, Paris, 1888, tom. i. p. 433; second case, *ibid.*, p. 506; third case, *ibid.*, p. 517.

²⁵ *Annales de la Société Médico-Chirurgicale de Liège*, 1891, tom. xxx. pp. 143-148; second case, *ibid.*

²⁶ *Laitopis khirurgicheskago Obshestva*, Moskva, 1891, vol. x. pp. 37-41.

²⁷ *Revue Internationale de Rhinologie, Otologie et Laryngologie*, May 10, 1893, tom. iii. p. 100.

²⁸ *Meditsinskoe Obozrainie*, Moskva, 1888, Bd. xxx. S. 227; cited in *Annual of the Universal Medical Sciences*, 1889, vol. iv. G p. 37; second and third cases, *ibid.*

²⁹ *Lancet*, London, 1889, vol. ii. p. 1325; second case, *ibid.*

³⁰ *Norsk Magazin for Laegevidenskaben*, Christiania, December, 1887, S. 889.

³¹ *Revue Internationale de Rhinologie, Otologie et Laryngologie*, May 10, 1893, tom. iii. p. 100.

³² Reported to the Royal Academy of Medicine, Ireland, December 9, 1887; *Journal of Laryngology and Rhinology*, 1888, vol. ii. p. 252.

³³ *St. Petersburg Medizinsche Wochenschrift*, 1889, No. 20, N. F., Bd. vi. S. 177.

³⁴ *Annals of Surgery*, St. Louis, 1891, vol. xiii. p. 100.

³⁵ *Medical Chronicle (Manchester)*, 1887-88, vol. vii. p. 192.

Adding to this collection the one hundred and six operations reported by Fischer, we have a total of one hundred and fifty-six cases,—one hundred and nine recoveries and forty-seven deaths. Of these fifty cases the youngest was a child two and a half years old operated on by Jalaguier for the removal of a leaden disk the size of a two-franc piece; the oldest, a person sixty-five years of age, operated on by Sklifosovski for the removal of a tooth-plate which had been impacted three days. Death occurred five weeks later from anæmia.

Of the different kinds of foreign bodies requiring an operation for their removal, tooth-plates predominate, showing thirteen cases, with seven recoveries and six deaths. Adding Fischer's collection to this, we have forty-eight cases of tooth-plates, with thirty-five recoveries and thirteen deaths. Of bones we have forty-nine cases, with thirty-one recoveries and eighteen deaths.

Dividing the substances according to their nature into rough and smooth bodies, including in the former tooth-plates and bones of various kinds, we have, of smooth bodies, such as coins, stones, pieces of meat, and fruit-stones, thirty-four cases, of which twenty-seven recovered and seven died.

The greater mortality from the lodgement of sharp or rough bodies over smooth ones is due to the greater amount of irritation caused, and the greater frequency with which ulceration, perforation, and gangrene of the œsophagus take place.

Œsophagotomy is indicated in all cases in which the foreign body is located above the sternum and cannot be removed *per vias naturales*; also in cases where it is lodged a short distance below the top of the sternum. Cheever¹ states that he has been able to reach and extract through an incision in the neck a foreign body situated as low down as the arch of the aorta.

Alexander² reports a case of œsophagotomy for the removal of a tooth-plate of irregular contour, with a sharp wire protruding from one side. It was situated between two and three inches below the level of the sternum, and after incision was exactly located by the finger and removed with urethral forceps. The patient made a good recovery.

The laceration of the œsophagus which may take place during extraction can also be successfully treated through the wound. By incision through the neck a direct avenue is furnished for draining and treating the diseased parts in cases of laceration, ulceration, or gangrene.

Fischer's rule regarding the time of operation is an excellent one to follow in cases of angular, lacerating bodies, as in such cases delay for a short time is often fatal. He says that if a foreign body cannot be extracted within twenty-four hours it must be removed by œsophagotomy,

¹ Boston Medical and Surgical Journal, 1886, vol. cxv. p. 579.

² Lancet, London, 1879, vol. i. p. 155.

and danger of suffocation demands immediate tracheotomy.¹ Delay is less dangerous in cases of round or smooth bodies.

The operation itself has been so simplified by modern antiseptic surgery that no surgeon should hesitate to undertake it. Durham² very truly says of it, "This operation may appear formidable in conception; but practically it is not difficult in execution, nor is it accompanied by any great risk. Experience shows that the chief danger is in delay."

A difference in opinion exists among surgeons, however, as to the advisability of suturing the wound in the œsophagus. This question must always be decided by the state of the patient and the condition of the wound. If the tissues through which the incision is made are normal, and the general condition of the patient is good, the suturing of the wound is not only advisable, but very much hastens recovery. If, on the contrary, the walls of the œsophagus are much inflamed, ulcerated, or gangrenous, and the patient's condition is not good, the wound should be left open for general antiseptic treatment and drainage.

Foreign bodies impacted so firmly in the lower part of the œsophagus that removal through the mouth is impossible may be extracted by the novel plan proposed by Hévin³ but revived by Richardson.⁴ He removed a tooth-plate impacted in the lower end of the œsophagus by first performing gastrotomy, then introducing the hand into the stomach. The tooth-plate was reached and extracted with the finger. This plan was suggested by the success attending this method of reaching and dealing with stricture of the lower end of the œsophagus.

And, finally, the plan proposed by Naseloff⁵ of resecting the ribs posteriorly for reaching foreign bodies impacted in the lower portion of the œsophagus may be resorted to. The practicability of this operation has not been demonstrated on the living subject, although its anatomical possibility may place it in the future among the well-recognized and frequently-performed operations of surgery.

¹ Op. cit., p. 297.

² Holmes's System of Surgery, vol. i. p. 729.

³ Op. cit.

⁴ Boston Medical and Surgical Journal, 1886, vol. cxv. p. 567.

⁵ Loc. cit.

CHRONIC DISEASES OF THE TONSILS.

BY CHARLES H. KNIGHT, M.D.,

Professor of Diseases of the Throat and Nose, New York Post-Graduate Medical School;

• Surgeon to the Manhattan Eye and Ear Hospital, Throat

• Department; etc., New York.

CHRONIC INFLAMMATION OF THE TONSILS. HYPERTROPHIED TONSILS.

CHRONIC amygdalitis, or inflammation of the tonsils, generally results in more or less hypertrophy. It may be of so low a grade as to offer but few, if any, of the usual features of inflammation, except at occasional intervals. The morbid process being of a very mild type, and perhaps limited to the lining membrane of the crypts, the tonsil itself may not be especially prominent. A history is ordinarily given of repeated attacks of sore throat of moderate severity. The tonsils may not be much enlarged, and are but seldom painfully inflamed. The fauces and pharynx give evidence of being in a state of chronic irritation, and the tonsils themselves are simply made up of a number of diseased crypts, at whose mouths appear, or from which may be expressed, masses of inspissated secretion. It is often very offensive from its prolonged detention in the follicles, and is at times extruded in the form of small pellets or balls which may be of such firm consistence as to resemble concretions. Such patients are frequently in depressed general health, suffer more or less from gastro-intestinal disturbance, and complain of discomfort and uneasiness in the throat rather than of pain. The actual enlargement of the tonsil is sometimes so slight that the diseased crypts are discovered only on rather careful exploration. This fact has led Roe¹ to describe them as "diseased tonsils unattended by hypertrophy." He recognizes two varieties: (1) chronic disease of the crypts and lacunæ; (2) fibroid degeneration of the stroma or cicatricial formation at the base of the tonsil. The former results from chronic follicular inflammation; the latter from frequent attacks of suppuration associated with follicular inflammation. Obscure reflex phenomena, neuralgia, pharyngeal and laryngeal irritation, and hoarseness often depend upon this condition. This form of tonsil has been described by Sokolowski and Dmochowski² under the name "chronic desquamative lacunar tonsillitis."

¹ New York Medical Journal, October 26, 1889. Transactions of the American Laryngological Association, 1889.

² Archives Internationales de Laryngologie, etc., 1891, tome iv., No. 6 et seq.

They find it characterized by increased secretion from the crypts, which accumulates, decomposes, and irritates the neighboring structures. The plugs of secretion thus formed are, as a rule, easily removed, but during an inflammatory attack they are apt to become firmly incarcerated and aggravate the trouble. These observers offer the following conclusions as to tonsillar inflammations in general: (1) hypertrophy of the follicles may lead to contraction or engorgement of the lacunæ, with retention of their contents; (2) inflammation of the tonsillar lacunæ, in which the secretion undergoes increase in quantity and change in quality, may be infectious or non-infectious, chronic or acute; (3) the chronic desquamative processes are more often in immediate relation with hypertrophy of the tonsils or with chronic catarrh of the lacunæ; (4) the so-called angina follicularis is nothing else than a pseudo-membranous inflammation localized in the lacunæ.

A good deal of space is devoted by Wagner, in Ziemssen's Cyclopædia, to an elaborate description of what he terms "atrophy of the tonsil." It is exhibited in four forms: congenital; from disease and from senile marasmus; post-operative, resembling the foregoing; and inflammatory atrophy. Its clinical importance is said to be slight. Frequently the lacunæ are dilated by accumulated secretion; they may open on the surface in a normal way, they may be contracted near their orifice, or they may be entirely obliterated. In some cases the size of the tonsil is not very much altered; in others, "in spite of the atrophy, it may be of normal size, or *even larger*." A condition of atrophy and of hypertrophy would appear at times to coexist in the same tonsil, giving the gland a very irregular contour.

In this connection reference should be made to an interesting pathological condition of the epithelium of the tonsil, which has received but little attention. It has been denominated by Zawarakin¹ "rarefaction of the epithelium." As the name implies, the epithelium is thinned in unequal degree in various regions, and probably as a result of pressure from beneath. It is said that the gland itself may be normal or diseased. According to Hodenpyl,² it has an important bearing upon "the absorption of bacteria and their ptomaines, and in the production of certain acute infectious diseases." It seems to be incapable of clinical demonstration.

Some observers consider a tonsil hypertrophied only when it projects beyond the plane of the palatine folds, a view not justified by pathology or clinical history. In a perfectly normal throat the tonsils are visible merely as small lobules of lymphoid tissue, situated between the folds, on the surface of which are barely perceptible the orifices of numerous crypts. We therefore include in the term "hypertrophied tonsils" all degrees of enlargement up to that which brings these bodies in actual contact. Cases are on record in which adhesion between the opposite tonsils had taken

¹ Anatomischer Anzeiger, 1889, No. 15, p. 467.

² American Journal of the Medical Sciences, March, 1891, p. 268.

place, while, on the other hand, a tonsil may be positively enlarged and still remain concealed behind the palato-glossal fold. The enlargement may be due to a low grade of inflammation, or it may be a genuine hypertrophy, such as all lymphatic glands are subject to, in which none of the ordinary phenomena of inflammation are present. The amount of disturbance excited by this condition depends upon the dimensions of the fauces and upon the temperament of the affected individual. In a phlegmatic subject, or in a capacious pharynx, tonsils of large size may cause but little discomfort, while, on the other hand, it is not uncommon to meet with tonsils barely projecting beyond the pillars of the fauces which produce excessive annoyance and possibly even serious subjective symptoms. According to Wagner,¹ it is more rare to see a normal tonsil than to see manifold deviations from the normal condition.

From a pathological stand-point hypertrophied tonsils may be divided into (1) the hard or fibrous and (2) the soft or adenoid, as suggested by Lasègue.² They have been elaborately studied by Ruault,³ who describes the former as resulting from repeated attacks of acute or subacute amygdalitis, either not accompanied by nasal and pharyngeal disturbance, or if accompanied by such disorders these are developed at rather a late period. They disappear slowly at or some time after puberty. Marked examples have been seen in patients more than sixty years of age. The second form is more frequent, and occurs earlier in life. It is always associated with adenoids in the naso-pharynx, and frequently with lymphoid hypertrophy at the base of the tongue. The lesion involves the mucous membrane of the follicles rather than the parenchyma. The tonsils are, therefore, not apt to be enormously enlarged except during an attack of acute inflammation. They undergo atrophy somewhat earlier in life and more completely than the hard variety. It is not unusual to find the second form of tonsil merging into the first in consequence of repeated attacks of inflammation, which result in the development of new connective tissue. A similar classification is made by Bosworth,⁴ based on investigations by Mann, the two forms being denominated hyperplastic and hypertrophic respectively, the former involving the stroma of the gland and resulting in growth and proliferation of connective tissue, the latter involving mainly the glandular tissue.

For convenience of clinical study and from a therapeutic stand-point hypertrophied tonsils may be divided into three groups:

1. Those which are decidedly increased in volume, so as to interfere with deglutition and with respiration. It must be very rarely the case that tonsillar enlargement alone can affect the latter function. The direction and extent of the tumefaction are seldom such as to impede the air-passages, and we must seek a cause of the embarrassed breathing, so common in these

¹ Diseases of the Soft Palate, Ziemssen's Cyclopædia, vol. vi. p. 866.

² *Traité des Angines*, 1866.

³ *Archives de Laryngologie*, etc., April 15, 1888; also *L'Union Méd.*, May 26, 1887.

⁴ Diseases of the Throat and Nose, 1881, p. 128; 1892, vol. ii. p. 132.

cases, either in the nasal fossæ themselves, or, much more frequently, in the vault of the pharynx. So-called adenoids of the latter region are generally the cause of the difficulty in breathing, as well as of the ear-troubles, not infrequently occurring in the subjects of hypertrophied tonsils. The tonsil itself is but rarely, if ever, the cause of aural disturbance by direct pressure upon the Eustachian orifice. Functional disorders of the ear may at times arise from the dragging exerted by very large masses in the oro-pharynx, but it is hardly possible for the tonsil to actually touch the Eustachian cushion or cover the mouth of the tube. It has been pretty clearly shown by Harrison Allen¹ that the growth described by Yearsley,² "at the upper margin of the tonsil," as being capable of producing deafness and nasal speech, was really not a palatal tonsil, but a mass of pharyngeal vegetations.

2. Flat diffuse tonsils, which in their average condition project into the fauces but slightly, which become prominent during the act of retching, and which are prone to recurrent attacks of inflammation. They are often associated with a rheumatic tendency or diathesis, and it is in connection with such tonsils that we most often meet with suppuration, not in the body of the tonsil, but in the adjacent cellular tissue, especially at its upper border.

3. A third class of tonsils may encroach upon the pharyngeal space and yet not appear beyond the free margin of the half-arches, for the reason that in consequence of repeated attacks of inflammation the anterior pillar has become firmly adherent. In process of enlargement the tonsil carries with it the palato-glossal fold, which may be much thicker than normal or may be spread out over the surface of the tonsil in a thin veil of mucous membrane. In the latter condition the tonsil may be excised with impunity; in the former, the knife should be avoided until the fold has been detached. Cohen³ suggests that the tonsil will frequently diminish in size after having been released from the pillar, and recommends passing a probe between the pillar and the gland every day or two, to prevent readhesion. An instrument is in use at the Manhattan Eye and Ear Hospital, New York, proposed by the late Dr. E. P. Pond, a former member of the staff, consisting of a blunt rectangular hook, which in most cases answers the purpose. In some, however, the adhesion is so dense and firm that a pair of stout blunt scissors curved on the flat will be found most satisfactory. The redundant mucous membrane may be safely trimmed off, care being taken to avoid wounding the muscular structures. Heryng⁴ is in the habit of resecting the mucous membrane when it is largely in excess. In some cases the pillar and the tonsil are so amalgamated that no line of sepa-

¹ The Tonsils in Health and Disease, American Journal of the Medical Sciences, January, 1892; also Transactions of the American Laryngological Association, 1891.

² Treatise on the Enlarged Tonsil, etc., London, 1843, p. 58.

³ Diseases of the Throat and Nasal Passages, 1879, pp. 224 and 231; Transactions of the American Laryngological Association, 1887, p. 179.

⁴ Journal of Laryngology and Rhinology, November, 1889, p. 480.

ration can be detected, when the latter can be exposed only by a process of dissection.

The diagnosis of hypertrophied tonsils seldom presents any difficulty. Not infrequently the hypertrophy is unsymmetrical, but we rarely find one tonsil extremely large and the other nearly normal, except in syphilis or in the case of a neoplasm of some kind. If the hypertrophy is characterized by large development of connective tissue, the surface of the tonsil is smooth, the crypts having become more or less obliterated. It may assume a variety of shapes, being globular, pyramidal, or pendulous. In some cases it is flattened antero-posteriorly; in others, the surface is very irregular, owing to unequal distribution or intensity of the inflammatory process, or perhaps to circumscribed absorption or atrophy. In some cases the tonsil has a dense, hard, fibrous appearance; in others, it looks soft and even friable. These conditions may be verified by digital examination.

Hypertrophied tonsils are generally a source of discomfort rather than of pain. Frequently patients complain of a feeling of soreness and of a sensation like that of a foreign body. Difficulty in swallowing is not marked except during an exacerbation. It seems as though the parts become accustomed to the presence of these abnormalities. Occasionally the action of the velum is impeded and fluids regurgitate through the nose. Vomiting may be excited, especially on widely opening the mouth. Ruault¹ has reported cases in which this was a pretty constant symptom. Gastric derangements, dyspepsia, gastralgia, are mentioned by some observers as results of pharyngeal and tonsillar hypersecretion or perverted secretion, or as reflex neuroses.² An interesting series of experiments by Ruault seem to substantiate the statement that intermittent otalgia, impaired hearing, tinnitus aurium, cough, asthma, and vomiting may be dependent upon chronic inflammation of the tonsils. By touching the tonsil at different points with a galvano-cautery electrode these various reflex phenomena were excited.

As already mentioned, and as noticed by Balme and others, serious obstacle to respiration can occur only when the hypertrophy reaches excessive dimensions. The obstruction to breathing which compels the open mouth and gives a child the characteristic heavy, stupid expression is usually seated in the rhino-pharynx. Dyspnoea may become serious in a child whose tonsils already enlarged are attacked with acute inflammation and whose normal air-track is cut off by an accumulation of adenoids in the vault of the pharynx. The nutrition of a nursing infant may thus be dangerously interrupted. The impediment is apt to be especially marked during sleep, and a history of frequent starting up at night as if smothering, nightmare, and heavy snoring respiration is a common one in these children.

¹ Archives de Laryngologie, etc., April 15, 1888.

² Baudens, Gazette des Hôpitaux, 1833; Chassaignac, Gazette des Hôpitaux, 1854; Balme, De l'Hypertrophie des Amygdales, etc., 1888.

Several fatal cases have been reported, among them one by Blair¹ and another by Delavan.² The propriety of opening the trachea under such circumstances, or when the breathing-space becomes still further abridged by extension of inflammation to the larynx, may have to be considered. Tracheotomy has actually been done in a number of cases, as in those reported by Shaw, quoted by Lefferts,³ by Puech,⁴ and by McGuire.⁵ Some authorities recommend excision of enough of the swollen glands to ward off impending asphyxia, regardless of the presence of acute inflammation.

Among the respiratory neuroses attributed to enlarged tonsils are bronchial asthma and cough. The former is rare, the latter common. According to Balme, cases of asthma of tonsillar origin, and yielding on ablation of these bodies, were reported by Schmidt in 1877, and by Parker in 1879; and Ruault quotes from Rendu a most interesting observation. The cough is apt to be paroxysmal and periodic, and in certain cases seems to depend upon position. For example, in a case now under my own observation it always occurs if the patient lies upon the left side; in such position the right tonsil, which is the larger, seems to excite cough by impinging upon the epiglottis. Lennox Browne⁶ cites a remarkable case in a boy of ten years, whose persistent cough of six weeks' duration had resisted all known remedies and modes of treatment, but yielded at once and finally on removal of the tonsils.

The phonatory disturbances vary with the degree of enlargement. When it is extreme, articulation is difficult and indistinct, especially of the letters *l* and *r* (*paralalia literalis*).⁷ The pitch of the voice is raised. A case is often referred to in connection with this fact, in which a tenor singer was robbed of his two upper notes by ablation of his tonsils. The disturbances of the special senses are quite variable, and depend more directly upon concomitant lesions of the nasal chambers or of the rhino-pharynx. Impairment or perversion of taste may result from enforced mouth-breathing. The ocular troubles which accompany enlarged tonsils are most of them attributable to the general condition of lymphatism or struma. Of fifty-two cases examined by Ouspenski,⁸ half were deficient in size, weight, and chest-capacity, in a majority mental development was tardy, a large proportion had impaired hearing, and a small number were myopic.

A great deal of discussion has been devoted to the relation between enlarged tonsils and aural disturbances, but, as already intimated, impaired hearing is rarely, if ever, a direct result of the tonsillar lesion. It may be

¹ Medical and Surgical Reporter, Philadelphia, 1880, xlii.

² Wood's Reference Handbook, vol. vii.

³ New York Medical Record, 1879, xvi. 601.

⁴ Moniteur des Hôpitaux, 1857; also Gazette Hebdomadaire, 1857, iv. No. 34.

⁵ Medical News, Philadelphia, May 14, 1892.

⁶ Diseases of the Throat, etc., 3d ed., p. 252.

⁷ Wagner, Ziemssen's Cyclopædia, vol. vi. p. 975.

⁸ Annales des Maladies de l'Oreille, etc., July, 1888.

a reflex effect, as maintained by Ruault, Verdos,¹ and others, but in the majority of cases the ear-disorder should be ascribed to the adenoid hypertrophy in the vault of the pharynx.² Other theories have been advanced to explain the aural phenomena in certain cases, as, for instance, that of Itard,³ which attributes them to catarrhal swelling and inflammation of the mucous membrane, and that of Noquet,⁴ which finds a cause in paresis of the tensor palati muscle, resulting from the general pharyngeal inflammation. In consequence, the Eustachian tube is not sufficiently opened during deglutition.

Hypertrophy of the tonsil is probably never congenital, but instances of its appearance very early in life are on record. It may be inherited, and it is customary to find it in several members of the same family. Its victim is generally endowed with a feeble constitution or a strumous diathesis, but we often meet with cases in which there is absolutely no other evidence of scrofulous taint. It is essentially a disease of childhood, and but rarely makes its first appearance after maturity. In the majority of cases there is a history of previous attacks of acute inflammation. The fact that such a history is sometimes absent may be explained by the chronicity of the process from its inception in certain cases, and in others by the obtuseness of the individual. It is a matter of common observation that children with large tonsils are apt to be dull and slow. Semon⁵ has drawn attention to the fact, of which we meet with frequent examples, that recurring attacks of tonsillitis sometimes lead to no marked increase in the size of the glands, while, on the contrary, one meets with enormous tonsils which give inconvenience merely by their presence and not by any special tendency to inflammation.

The ill effect of enlarged tonsils upon the general health is unquestionable, and receives striking confirmation in the improvement which almost invariably follows their removal. Even when they are not so large as to give noticeable obstruction and induce those deformities of the chest-wall which were first described by Dupuytren⁶ and afterwards by Shaw,⁷ Lambron,⁸ and others, and the peculiarities of physiognomy which are by some considered characteristic, they are a source of local disturbance which is more or less reflected upon the system at large. Hardly less important is the rôle they play in the matter of contagion. A large, ragged tonsil must be an inviting resting-place and offer congenial soil for the development of morbid germs. Clinical evidence that in the event of contagion they become a serious com-

¹ Rev. de Laringol., Otol. y Rinol., Barcelona, March, 1889.

² Meyer, Archiv für Ohrenheilkunde, vols. vii. and viii., 1873, 1874.

³ Maladies de l'Oreille, Paris, 1842.

⁴ Bulletin Médical du Nord, 1879.

⁵ St. Thomas's Hospital Reports, 1883, vol. xiii. p. 129.

⁶ Répertoire d'Anatomie et de Physiologie, 1828, tome v.

⁷ Medical Gazette, October 29, 1841, p. 187.

⁸ Bulletin de l'Académie de Médecine, 1861.

plication and lessen the chances of recovery is abundant. It is a little remarkable that the etiological relation between hypertrophied tonsils and deformities of the thoracic parietes, as enunciated by the followers of Dupuytren, who himself appears merely to have noticed the coincidence, should so long have received unquestioning acceptance. Since Meyer,¹ of Copenhagen, drew attention to the condition known as "adenoids" in the vault of the pharynx, much light has been thrown upon the pathology of this region, until we are in a position to say that in reality the tonsils play a minor part in the causation of those deformities. Each of these conditions, tonsillar hypertrophy and adenoids, is no doubt a result and an indication of a dyscrasia which has been graphically described by Potain² under the name "lymphatism."

We therefore find the enlarged tonsil in many cases a source of constitutional disease by furnishing a mechanical impediment to proper respiration, if not independently, at least in conjunction with stenosis of the nares or of the rhino-pharynx. Moreover, the inspired air must be more or less vitiated by passing over the decomposing secretion often provided by diseased tonsils. In addition to various reflex neuroses which may reasonably be referred to this lesion, we have seen that it is a positive etiological factor in the production of certain functional disorders and even organic disease of neighboring cavities, nasal, aural, pharyngeal, and laryngeal. Yet, in spite of their extensive capacity for evil, we sometimes hear the advice given "not to meddle with enlarged tonsils, but to let the patient outgrow the condition." A valid reason for this is hard to find. That old superstition which apprehended injury to the sexual organs from their removal does not deserve serious consideration. As will presently be shown, the supposed danger attending their removal is a bugbear which has been pretty thoroughly dispelled by modern methods and observation. The voice may be slightly lowered in pitch in consequence of ablation of the tonsils, but this is more than compensated for by the marked improvement in quality and resonance. The transformation in the aspect of a child whose growth has been stunted and mental development retarded by these hypertrophies, even within a few weeks after their removal, is often simply marvellous.

Treatment.—The constitutional treatment of enlarged tonsils is unsatisfactory in the majority of cases. Good hygiene, careful diet, and tonics are of service in struma and anæmia. Derangements of digestion should be corrected. The appropriate internal medication should be adopted in case of a gouty or rheumatic diathesis. The tendency to exacerbations may be in a measure controlled by cold bathing, exercise, and proper care of the skin. In short, everything which tends to improve the general health will have more or less influence upon the local condition, but the fact remains that in most cases the hypertrophy will not yield. Moreover, we have to

¹ Transactions of the Medico-Chirurgical Society, London, 1870, vol. iii.

² Dictionnaire Encyclopédique, Paris, 1870, n. s., vol. iii. p. 484.

contend with the difficulty in getting our patients to carry out instructions regulating their mode of life. The fact should also be recognized that in many cases whatever constitutional defects and weaknesses may be present are in large part referable to the tonsillar hypertrophy and are best remedied by removing the latter. It is quite true that a child is likely to outgrow the condition. Only a small percentage of hypertrophies persist to a damaging extent after puberty; but in the mean time the patient is exposed not only to the injurious effects of this morbid condition upon the general system, but to the danger of permanent injury to neighboring organs. In an examination of two thousand children, Chappell¹ found two hundred and seventy cases of enlarged tonsils, and he concludes that by their interference with the circulation and with respiration they are an important element in the production of catarrhal affections. In addition we must admit the risk of contagion and its probable consequences under such circumstances. The hard tonsil, sometimes called the scirrhus tonsil, does not shrink to a marked degree at puberty and is but slightly influenced by general or local treatment, other than surgical. The soft tonsil may be reduced to some extent by the more powerful astringents or by interstitial injections of iodine solutions (Seiler²) or dilute acetic acid (Mackenzie³). Massage is referred to by many writers, but evidently it has not been extensively used. Good results have been reported by Quinart,⁴ who recommends rubbing powdered alum into the tonsil. The question naturally arises whether the benefit of this method may not have been due quite as much to the astringent as to the manipulation. Cohen states that frequent compression of the gland between the fingers of each hand, one upon the tonsil and the other externally, assists the process of absorption. Electrolysis has had at times more or less popularity. This procedure is said to be facilitated by the use of a bifurcated needle, suggested by Coit,⁵ which carries the negative current and is inserted in the tonsil, the positive electrode being applied externally. The applications are made once a week, are painless and bloodless, and are supposed to promote "absorption of the fibrous exudation without destroying the mucous membrane." De Blois⁶ claims to have obtained good results in adults with electrolysis, making half a dozen punctures each day. Cohen⁷ mentions having used it successfully in certain cases, while in others the results attained were not worth the trouble. At best it appears to be a most tedious process, and it seems probable that the other measures generally used in conjunction with the electrolytic treatment are at least equally responsible for whatever slight shrinkage may take

¹ American Journal of the Medical Sciences, February, 1889.

² Diseases of the Throat, 3d ed., p. 246.

³ Diseases of the Throat and Nose, 1880, vol. i. p. 69.

⁴ Archives Médicales Belges, 1878, from Journal de Médecine et de Chirurgie Pratiques, No. 12, 1878.

⁵ New York Medical Record, April 3, 1891.

⁶ Transactions of the American Laryngological Association, 1889, vol. xi. p. 78.

⁷ Diseases of the Throat, etc., p. 233.

place. None of these methods is of much value when the supply of new connective tissue in the body of the tonsil is profuse, when an adherent pillar prevents the tonsil from resuming its normal proportions, when the tonsil is flat and buried, so to speak, and in that form of tonsil which has been described, and which is a source of mischief by causing irritation as a foreign body in the pharynx and by retaining decomposing secretion within its crypts.

We are compelled, therefore, in most cases to resort to surgical measures or destructive agents. Two questions arise, one relating to the time of operating, the other to the method. The former is easily answered, provided we admit that the enlarged and diseased glands are a potent cause of ill health. It is waste of time to attempt to repair a broken constitution while the most prominent cause of the disordered state is allowed to persist. Those cases must be rare indeed in which delay is necessary. It would be wise to postpone radical interference in case of the prevalence of an epidemic, or if the patient happens to have some acute concurrent disease. We should certainly not choose to operate on a tonsil in an acutely-inflamed condition. Yet Cohen¹ advises taking advantage of the increase in size during an attack of sore throat to remove a portion of those tonsils which are in their usual state not accessible. Delavan² says that, as a rule, the operation should not be done during an attack of amygdalitis, but he finds it necessary in certain cases, and succeeds in removing more of the redundant tissue than would be possible if the tonsil were quiescent. He suggests operating at the beginning of an attack. It is the custom of Kitchen³ to excise the tonsil when an attack of quinsy is threatening. He claims thus to abort the disease and prevent its recurrence. On the other hand, Seiler⁴ earnestly deprecates any operation for the reduction or removal of an acutely-inflamed tonsil. We should expect more bleeding and greater pain than usual, but nevertheless in the presence of urgent symptoms, such as impending asphyxia from extraordinary swelling, we should not hesitate to operate.

In selecting a method of operating, many factors must be considered. From what has been said of the varieties of hypertrophied tonsils, as regards size, shape, and relations, it is obvious that no one method is adapted to all cases. The supposed risk attendant upon cutting the tonsil has induced an extensive trial of bloodless substitutes. Almost all in the list of chemical caustics have at times been employed. Not more than three have proved of permanent value,—namely, nitrate of silver as recommended by Holmes,⁵ chromic acid as used by Donaldson,⁶ and London paste,

¹ Op. cit., p. 225.

² Wood's Reference Handbook, vol. vii.

³ New York Medical Record, January 16, 1892, p. 69.

⁴ Op. cit., p. 250.

⁵ London Lancet, 1882, p. 798.

⁶ Cohen, Diseases of the Throat, p. 233.

the last highly praised by Morell Mackenzie.¹ Silver nitrate, fused on a probe, or the solid stick, may be passed into the crypts. Chromic acid is said to be most efficient if inserted in small incisions made in the tonsil. The paste is applied to the surface of the tonsil with a spatula, and the patient is directed to remove the excess of caustic by gargling with cold water. The action of these agents is so superficial that many repetitions are required, and it is limited with so much difficulty that they can be safely used only when we have the co-operation of our patient.

The foregoing objections apply with less force to galvano-cautery puncture and ignipuncture. These agents are much more precise, and the immediate pain and the inflammatory reaction are seldom excessive. In a tolerant patient very rapid work may be done, nearly the whole tonsil sometimes being destroyed at a single sitting.² In spite of the testimony of many recent writers, Saint-Germain³ in particular, children do not submit quietly to this method of treatment, and even in adults, and with the free use of cocaine, a good deal of complaint is made. Galvano-cautery puncture is undoubtedly the best resource in those broad, flat, adherent, and deeply-embedded tonsils which cannot be reached at all with the guillotine, and whose removal with the knife is more or less difficult and hazardous. Krishaber,⁴ who is an ardent advocate of ignipuncture, sums up his views as follows: it is not painful; it is attended by no complications, and results are prompt; its application is easy, and its use, except in rare cases, demands no extraordinary skill. Three objections to a cutting operation, from which ignipuncture is exempt, are suggested by Valat,⁵—namely, recurrence, diphtheritic infection, and hemorrhage. The chief advantage of this method is that it is so completely under one's control. You may do as little as you please or as much as your patient will endure. Having some regard for his subsequent suffering, it is unwise to burn more than three or four points at one sitting. It is a good plan to select a number of crypts near one another and cauterize them in succession, passing a cold electrode to the bottom of the crypt and burning out to the surface of the tonsil. In this way large segments of tissue may be destroyed, and there is no opportunity for the slough to be retained and enclosed in such a way as to become a focus of suppuration. Pyncheon⁶ advocates removal of the tonsils by a process which he calls "electro-cautery dissection." From *fifteen minutes to an hour* are required to remove a tonsil by this method, five to twenty seconds out of each minute being devoted to actual burning. One tonsil is taken at the first sitting, the second being attacked after an interval of two weeks.

¹ Diseases of the Throat, 1880, p. 68.

² Rice, Transactions of the American Laryngological Association, 1889, p. 86.

³ Revue des Maladies de l'Enfance, 1884, ii. 520; also Transactions of the Ninth International Medical Congress, vol. iii. p. 457.

⁴ Annales des Maladies de l'Oreille, etc., July, 1880, p. 63; 1881, p. 124.

⁵ Gazette des Hôpitaux, November 17, 1888.

⁶ Journal of the American Medical Association, November 22, 1890.

Patients are said to suffer less at the second than at the first operation, from which they generally experience so much relief that they solicit the removal of the second tonsil. The gland is seized with tenaculum or forceps and simply separated from its attachments by repeated strokes of the cautery-knife. It must be quite an easy thing to do on the dead subject. Objection is made to galvano-puncture on the ground that it leaves "a ragged and bad-appearing surface," precisely what it should not do if properly performed. Kellogg¹ praises electro-puncture for two reasons: it cuts off the vascular supply of the tonsil, thus preventing sudden engorgement and inflammation, and absorption far exceeding the destructive action of the cautery is promoted. The treatment of enlarged tonsils by galvano-puncture is unreservedly condemned by Désiré² because its results are imperfect and not positive. Moreover, he has little or no apprehension of hemorrhage. He has collected about twenty thousand cases of tonsillotomy, and has found only nine of hemorrhage, none fatal and several not even serious. Cuvillier believes that cauterization is admissible in hæmophilia. Quénu uses the cautery at all ages. A disregard of the sensations of our patients, an abnormal dread of hemorrhage, or the employment of imperfect technique may possibly explain this extraordinary divergence of opinion.

Enucleation by means of the finger was practised by Celsus, and since his day it has been occasionally used.³ It seems to be easily performed, except when the gland is more than usually adherent. The contusion of the parts attending the removal of a tonsil in this way would be likely to be followed by an excessive degree of soreness, but the extirpation is practically complete and there is no bleeding. As compared with other methods it has no features worthy of commendation.

With the cold-wire snare, as proposed by Jarvis,⁴ primary hemorrhage should not occur, provided the section be not too rapid; but there is always a possibility of secondary bleeding, unless the usual precautions as to diet, exercise, clearing the throat, etc., are observed. The process is sometimes, in spite of cocaine, extremely painful, the tightening of the loop upon the tissues at the base of the tonsil becomes more and more difficult as it progresses, and the subsequent distress of the patient is often excessive. Two or three hours may be consumed in removing a tonsil in this way, and the patient may be allowed to manipulate the instrument himself after it has once been adjusted. Thus a minimum of pain is insured and little or no blood is lost. Bland diet should always be insisted upon, and hot applications externally, steam inhalations, and even anodynes may be required to combat the reaction and pain, which may last many hours. The difficulty

¹ New York Medical Times, November, 1890.

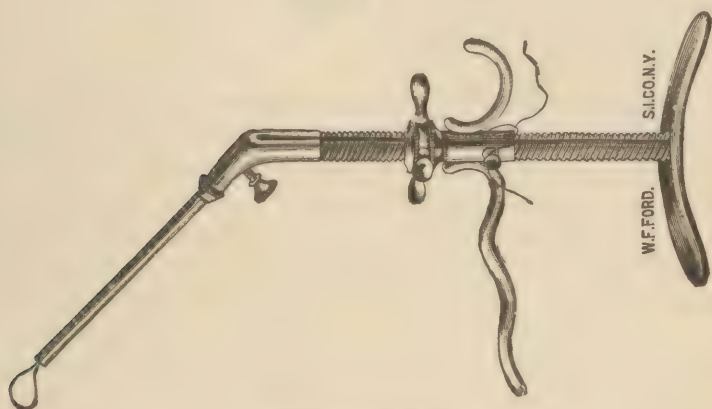
² Thèse de Paris, 1890.

³ Bernardino, Ranking's Abstract, 1862, p. 240; Borelli, *Gaz. Med. Ital. Prov. Sard.*, December 30, 1861; Larghi, *Presse Médicale Belge*, No. 10, 1862; Farmer, *British Medical Journal*, March, 1884, p. 602.

⁴ *Journal of the American Medical Association*, vol. i. No. 1.

in cutting through the tonsil may be in part obviated by using suitable wire and a powerful instrument like that devised by Bosworth. (Fig. 1.) Jarvis uses No. 5 steel piano wire. Some trouble may be found in applying the loop to the tonsil, especially in an intolerant patient. This difficulty may be overcome by using a canula designed by Toison,¹ which ends in a fenestra intended to surround the tonsil. The wire, instead of being free, is attached to the ring of the fenestra by fine silk threads, which are easily broken the moment traction is begun. Ingals² recommends removal of tonsils in children with cold wire and under ether. He uses a specially-constructed forceps for seizing and holding the tonsil while the loop is being applied. This method has a single advantage over the next to be described (the cautery loop), in that it requires no elaborate and costly apparatus. It is decidedly inferior to the latter as regards the time employed in the opera-

FIG. 1.



Bosworth's tonsil snare.

tion, and it is at least equally objectionable as regards immediate and subsequent pain.

In the adult in whom we may have reason to expect hemorrhage, or who refuses to be cut, the galvano-cautery snare, or Wright's³ ingenious adaptation of the electric current to the frame of the Mackenzie guillotine, will be found serviceable. (Fig. 2.) Some dexterity is doubtless required for the successful manipulation of the snare, which is not the case with the electric amygdalotome. The latter is used precisely as if it were a cutting instrument. The most satisfaction will be found with these methods in protuberant tonsils from which the palatal folds are quite free. If platinum wire is used in the snare, considerable difficulty may be found in engaging the tonsil in the loop. The tonsil may first be transfixed at its base with a long, slightly-curved needle, over which the wire may be passed, or the

¹ *Lille Médical*, October, 1890.

² *Sajous's Annual*, 1890.

³ *New York Medical Journal*, August 30, 1890.

wire may be carried into position and held behind the tonsil by means of a two-pronged instrument, made of flexible copper and held firmly in a handle.¹ After the loop has been tightened and the current turned on for

FIG. 2.



Wright's electric amygdalotome.

an instant, the wire adheres so that the needle or fork may be withdrawn and the section completed at leisure. Iridio-platinum wire, suggested by Gleitsmann,² serves the purpose much better than platinum, for the reason that it is more resilient and is less easily displaced. Ordinary steel wire, such as is used in the cold-wire snare, is still better, but of course after having once been heated

loses its elasticity. With Wright's amygdalotome it is comparatively easy to include as much of the tonsil as may be desired, but it is rather an uncomfortable piece of machinery to hold in the mouth for the relatively long time required to divide the base of a tonsil of magnitude. With either of the preceding methods the base of the tongue and the pillars of the fauces are apt to be damaged by the heat in spite of the utmost care. No permanent harm is likely to ensue, but the discomfort of the patient is vastly increased by such an accident. It may be averted by using a device similar to that suggested by Toison for the cold snare. (Fig. 3.) The double canula carrying the wire (No. 30 platinum) is attached to a solid steel shaft, from which it is thoroughly insulated. The shaft ends in a ring whose vertical diameter is longer, to correspond with that of most tonsils. The ring may be of different sizes. The loop is shaped to adapt itself to the ring, to which it is fastened by a single thread at its distal extremity. The tonsil having been surrounded by the ring, traction is

FIG. 3.



Author's electric tonsil snare.

made on the loop, bringing it in contact with the tonsil above and below. At this instant the current is turned on, the thread holding the wire is burned through, the wire buries itself, and the further steps of the opera-

¹ Transactions of the American Laryngological Association, 1889, p. 80.

² New York Medical Record, March 17, 1888.

tion are simple. It is well to avoid excessive heat and violent traction on the wire, which is apt to break if drawn upon while very hot. A firmer, deeper eschar seems to follow the plan of making traction and burning alternately. It should always be remembered that the heat should be allowed to do the work, the loop being drawn down each time only sufficiently to cut through the portion of tissue that has been burned. The instrument should, of course, always be so applied as to carry the ring first over the base of the tonsil, the wire loop lying on its inner surface.

A recent personal experience with the cautery-loop operation was rather unusual. A woman, about thirty-five years of age, was sent to my clinic with two of the largest tonsils I have ever seen in the adult. She gave a history of having had several attacks of rheumatism and of neuralgia, and of not having passed a winter within her memory without at least one severe attack of acute tonsillitis, several of them suppurative. In addition, she disturbed her neighbors by her snoring at night, and was often awakened by her own uproar. She suffered somewhat from rhinopharyngitis, but was otherwise in good health, and, in spite of the extraordinary local condition, had the appearance of being an unusually vigorous and healthy patient. Both tonsils were very ragged, the left being a little the larger, and their crypts were very deep and patulous. The pillars were not adherent. The right tonsil having been thoroughly swabbed with a twenty-per-cent. cocaine solution, it was removed in a few seconds with the "electric tonsil snare." The patient was perfectly submissive, but declared that the pain was considerable. The stump was brushed with a strong solution of menthol in fluid albolene and then dusted with subgallate of bismuth. The pain soon subsided, and the patient was sent home with the usual explicit directions as regards diet and exercise. She remained free from discomfort for about two hours, when very severe pain began in the left ear. It continued with varying acuteness for fourteen hours, when she was given three grains of acetanilid every hour, and was told to apply a hot-water bag externally and to dust the fauces with a powder of stearate of zinc containing two per cent. of menthol. Relief came in the course of an hour. It was noticeable that the local reaction was less than is often seen after excision. Neither pillar had apparently suffered from the heat, although the posterior one was slightly swollen and œdematous. The heavy breathing in sleep had completely ceased, and there was marked increase of vocal resonance. It is worthy of notice that there was at no time the slightest constitutional disturbance. At the end of a week the slough had entirely cleared away, the local reaction had almost subsided, and a diminution in size of the *left* tonsil was quite apparent. The only complaint was of slight pain after eating, daily getting less.

This method has two advantages. In the first place there is no difficulty in putting the wire around the tonsil, and in the second place the velum and the dorsum of the tongue are guarded by the steel ring, which remains perfectly cool. The total result of the operation is not measured by the

amount of tissue actually removed, since the parts left behind are cauterized to a considerable depth. The reaction after removing a tonsil in this way at one sitting is perhaps greater than after any other method, unless extraordinary precautions are observed as regards exercise and exposure. It is customary to excise both tonsils at one operation; it is good policy to limit the cautery-loop operation to a single tonsil at a time. The second may be removed a week or ten days later. It is to be recommended only in adults possessed of rather more than average fortitude. It cannot be used in children, except with the aid of an anæsthetic, and is not feasible in the case of flat, deep-seated tonsils. With each of the foregoing methods an adherent pillar should first be released.

Avulsion with forceps and ligation deserve merely passing mention. The former seems to have been practised in very early times, while the latter was advocated by Ambroise Paré, Guillemeau, Moscati, and others. In referring to the latter, Krishaber remarks that it is dangerous because of the inflammatory reaction likely to ensue. The former is very far from being a highly scientific procedure, and no valid excuse can be found for either, in view of the improvements in modern surgery.

Before taking up the consideration of cutting operations, it may be well to review the testimony bearing on the question of hemorrhage after excision and enumerate the reasons for choosing a bloodless method. A great deal of harm has been done by the extravagant claims of the advocates of the electric cautery and by the warnings of those alarmists who never use the knife. There seem to be but four conditions which may give a possible excuse for resorting to comparatively slow and painful ways of getting rid of the offending organs: (1) Hæmophilia, which is a decided contra-indication to cutting operations. (2) Suspected or apparent vascular anomalies. The ascending pharyngeal artery is sometimes misplaced, and is said to have been wounded by so great a surgeon as Billroth,¹ while operating with a bistoury. A large vessel sometimes courses along the margin of the anterior pillar, and might be divided lengthwise and give rise to troublesome bleeding, as in a case met with by Weir. Care should be taken to see that the pillar is free from the tonsil and that the shaft of the amygdalotome is held parallel with the median line. Accidents have occurred from wounding the venous plexus situated at the lower border of the tonsil. This is not likely to be a source of trouble in children. Finally, the tonsillar artery may be abnormally large, and, moreover, may be prevented from retracting and sealing up its divided extremity by the new connective tissue developed in the body of the tonsil. Pulsation in the tonsil itself, perhaps visible, and possibly to be detected only on palpation, has been referred to as a forewarning of danger. A high degree of vascularity in the mucous membrane of the tonsil is regarded with suspicion by some. Gleitsmann,² for example, while admitting that there are no positive signs

¹ J. Walker Downie, *Edinburgh Medical Journal*, August, 1886, p. 116.

² *Philadelphia Medical News*, January 19, 1889.

by which we may anticipate hemorrhage, looks upon this appearance as a danger-signal. Clinical experience tends to show that it is not the vascular-looking tonsil, but rather the pale fibrous tonsil of the adult and of advanced childhood, which gives us trouble, and especially if the section be made through the middle of the gland, where the blood-vessels contract with difficulty, rather than at its base, where the tissues are more elastic. (3) Anatomical peculiarities. The tonsil may be so flat or so deeply seated that it is impossible to surround it with the ring of the guillotine. The use of the knife or scissors is tedious, and in a struggling child or a nervous adult positively unsafe. (4) The patient may refuse to submit to a cutting operation. As regards immunity from risk in the procedures which have been thus far described, it must be said concerning the cauterizing methods that, in addition to being slow and painful, they are open to certain objections, the most important of which is that they do not insure absolute protection against hemorrhage. There is undoubtedly more reaction after burning than after cutting, and the danger of phlegmonous inflammation is greater. A case of alarming hemorrhage in a child eight years of age, occurring five days after the use of the cautery-snare, has been reported by Capart.¹ It seems to have been provoked by immoderate use of the voice. A case reported by Werner² is said to have been saved by compression of the carotid for ten days and to have been brought to a dangerous condition of anæmia.

Hernandez³ reports a case of a lady, twenty years of age, whose tonsil was removed at one sitting with the thermo-cautery. Eight days later hemorrhage came on, which astringents failed to check, but which was finally controlled by pressure. Heryng⁴ met with a case of hemorrhage the day after having removed a tonsil with the cautery-loop.

There seems to be an impression that suppurative inflammation is more apt to follow cauterization than the knife. Moure,⁵ who prefers excision except in adults, asserts that he has seen retro-pharyngeal and circum-tonsillar abscess caused by the cautery. These accidents may be avoided by ordinary care in operating and subsequently as to diet, exercise, and use of the voice. On the whole, we may resort to the use of the cautery in suitable cases, which are certainly exceptional, with a feeling of security and with the expectation of getting a thorough and satisfactory result.

In investigating the subject of hemorrhage after removal of the tonsil it is important to take into account two points, the age of the patient and the method of operating. It is an established clinical fact that nearly all cases of alarming bleeding have been in the adult, and a large majority

¹ Transactions du Congrès International de Laryngologie, Milano, September, 1881, p. 96.

² Würtemberger Medicinisches Correspondenz-Blatt, No. 31, 1888.

³ El Progreso Médico, Havana, October, 1890.

⁴ Journal of Laryngology, July, 1888, p. 283.

⁵ Journal of Laryngology and Rhinology, July, 1888, p. 283.

of them have occurred after the use of the bistoury. The matter has been made the subject of elaborate study by Lefferts,¹ Delavan,² and Moure.³ Lefferts summarizes his conclusions as follows: (1) A fatal hemorrhage after the operation of tonsillotomy is rare. (2) A dangerous hemorrhage may occasionally occur. (3) A serious one, serious as regards both possible immediate and remote results, is not unusual. (4) A moderate one, requiring direct pressure or strong astringents to check it, is commonly met with. Delavan coincides with the last three propositions, and in regard to the first asserts that he has not succeeded in finding the authentic record of a single fatal case after excision performed in accordance with modern methods,—a statement in which Roe concurs. Moure gives the history of an alarming case in a child of seven years. The hemorrhage was in this case attributed to the extremely bad general condition of the patient and to the enormous size of the tonsils, requiring the use of the adult guillotine. In comparing cauterization with excision he expresses a preference for the latter in children and for the thermo-cautery or the galvano-cautery in adults. Aside from hæmophilia there are four possible sources of dangerous hemorrhage after excision of a tonsil: (1) an anomalous ascending pharyngeal artery; (2) a large artery in the anterior pillar; (3) the venous plexus at the lower border of the tonsil; and (4) one or several large and patulous tonsillar arteries, the last-mentioned being by far the most common. The origin of the bleeding has an important bearing on its treatment, and we should, if possible, determine this point as early as possible, rather than blindly resort to the use of styptics. It is a curious fact that a large proportion of the serious hemorrhages have been secondary: so that we need not become unduly alarmed at a rather free bleeding at the time of the operation. It is well to prohibit the use of the voice, to insist upon fluid diet, and to restrict exercise, for four or five days after operation. Should the bleeding not begin to subside within two or three minutes after the cutting, it will be desirable to try to find its source. This is by no means an easy thing to do, especially in a nervous adult or a frightened child, when the effusion is so free as to require constant clearing of the throat. It is generally the case that the bleeding ceases spontaneously on the approach of syncope, if not before, and recurrence is unusual if the patient is kept quiet and free from excitement. This accident is so rare in children as hardly to deserve attention: its seriousness in adults has been greatly exaggerated.

A search of the records of the Surgeon-General's Office for a period of twenty-five years discovered only thirty-one cases of what might be called serious hemorrhage. In nine the ages were not given. Two were children, one being a hæmophile and in the other the internal carotid pursued an abnormal course. The remaining twenty were all over eighteen years of

¹ Transactions of the American Laryngological Association, vol. iii., 1881, p. 135.

² Ibid., vol. x., 1888, p. 153.

³ Revue de Laryngologie, December 15, 1890.

age. According to Mackenzie, four cases have been reported by Velpeau in which the internal carotid was wounded in excising a portion of the tonsil with a bistoury. In Ricordeau's well-known thesis two fatal cases in the practice of Broca are referred to, and two in that of Cheselden.

It is the practice of Rice¹ to resort to one or other of two expedients in case he finds reason to apprehend hemorrhage. Sometimes he cuts a groove with the cautery at the base of the tonsil sufficiently deep to destroy the blood-vessels, and then removes the undermined tonsil with scissors or the tonsillotome. Again, he uses a dull tonsillotome and pushes the blade slowly through the tonsil. Several minutes may be consumed in the operation. Thus the vessels are compressed, and the bleeding is much less than it would be after rapid section with a keen blade. The pain is not severe, and the instrument is easily tolerated in the mouth for the necessary time, provided the head be inclined forward so as to permit the saliva to flow from the mouth. He objects to the use of cocaine, on account of the probability of bleeding when the vessels relax as the effects of the drug pass away.

It is worthy of notice that many of the hemorrhages in adults, in whom the guillotine was used, followed a partial excision; in other words, the cut was through the middle of the organ at a situation most rich in new connective tissue, and consequently where the blood-vessels were prevented from closing.

The management of these cases is usually simple enough, provided the patient can be reassured and the surgeon does not lose his head. Something must be done to quiet the general agitation, and perhaps the most harmless expedient is to let the patient hold small pieces of cracked ice in his mouth. The circulation, which is naturally somewhat excited, may be still further calmed by applying ice-bags externally and by the administration of opium. Styptics should be altogether abjured, except perhaps tanno-gallic acid, so much lauded by Mackenzie, who says he had not seen a hemorrhage to amount to anything since he began its use. It is composed of one part gallic acid and three parts tannic acid in watery solution of rather thick consistence, which the patient is directed to sip and swallow, thereby forcing the mixture into the stump of the tonsil. It is not a very pleasant drink, and it is probable that such a hemorrhage as it is capable of controlling would cease nearly as soon without it. All other styptics are delusions.

If the foregoing measures fail and the bleeding is not immoderate, it may be possible to isolate the bleeding point, seize it with a torsion forceps, and twist it. This has been successful in a number of reported cases, among them one by Clinton Wagner,² who discovered a spurting artery near the root of the tongue which he controlled by torsion. Similar success attended this manœuvre in one of Lefferts's cases after prolonged and fruitless use of pressure and persulphate of iron. The thermo-cautery is some-

¹ New York Medical Record, January 31, 1891.

² New York Medical Journal, April 16, 1887.

times effective, as in a case reported by Downie.¹ His patient was thirty-four years of age. Primary hemorrhage was no more than usual, but in six hours bleeding began, and ice, iron, ergot, and hazeline were tried in succession, but the flow continued until the application of the thermo-cautery.

In my own experience an attempt to check a tonsillar hemorrhage by means of a large flat electro-cautery tip failed, partly because the patient was very restless and partly because the bleeding was so free as to quickly cool and clog the electrode. Pressure will sometimes avail, and may be accomplished by the finger or instruments like those of Ricord, Mikulicz, and Clendinnen (Fig. 4). The first two are regulated by a thumb-screw,

FIG. 4.



and are much the most powerful. The last is a spring instrument, and the tonsil pad is furnished with sponge, which, if desired, may be saturated with some styptic. In the case reported by Hernandez, already referred to, the bleeding was arrested by means of long forceps, one of its blades, covered with chamois skin, on the tonsil, and the other external. It may be

feasible to surround the bleeding stump with a ligature of silk or wire. The former was used by Clarke² in the case of a male patient, forty-two years of age, in whom a portion of both tonsils had been excised with vulsellum and scissors. Tannin, turpentine, and styptic cotton were ineffectual. The Paquelin cautery checked the oozing, but did not control an arterial jet from the middle of the stump. Pressure was useless, and the patient was finally etherized and the stump ligated *en masse*. The ligature came away on the fourth day, and there was no recurrence of hemorrhage. In a case described by Butler,³ astringents, cold, and pressure having failed to check, the stump was drawn out with a tenaculum, transfixed with a needle, and ligated with silver wire which was left in position two days. As suggested in a paper read before the American Laryngological Association, "the loop of a cold wire snare may be applied, possibly with the aid of a transfixion-needle."⁴ A very ingenious plan was resorted to by Levis⁵ in an obstinate case. The stump of the tonsil was transfixed with a tenaculum, which was then turned so as to bring the flat

¹ Edinburgh Medical Journal, August. 1886.

² New York Medical Journal, July 7, 1888.

³ Ibid., November 2, 1889.

⁴ New York Medical Journal, October 12, 1889; also Transactions of the American Laryngological Association, 1889, vol. xi. p. 84.

⁵ Medical News, Philadelphia, December 8, 1888.

handle between the teeth. The jaws were then bandaged together. On withdrawal of the instrument the next day there was no return of the bleeding.

After failure of the foregoing expedients the question of ligation of one of the arteries in the neck may arise. It is doubtful if the common carotid should ever be tied for tonsillar hemorrhage. In Fuller's¹ case this was done without result. All known styptics and astringents, pressure, ice, injections of ergotin, and hot water, had no more than a temporary effect. The bleeding kept on exactly as before, after the ligature had been tightened around the common carotid. The patient finally fainted, and the hemorrhage ceased. Twelve ounces of saline solution were injected into the radial vein by Sands,² and the patient soon rallied. It is impossible to say how much the transfusion contributed to this result. It is interesting to note that the patient belonged to a family of bleeders, but was not one himself, as shown by the fact that the hemorrhage was from only one tonsil, and, moreover, there was no bleeding from the ligation wound. This case is very instructive in exhibiting the futility of various hæmostatic agents and in showing how the collateral circulation must defeat an attempt to cut off the vascular supply to the tonsil by obliterating the common carotid. The latter fact has been conclusively proved by Delavan, who demonstrates that the external carotid is the proper vessel to tie, since in the normal condition of things the internal carotid gives off no branches in the neck, and ligation of the common trunk offers no hinderance to the transit of blood through the circle of Willis from the opposite side. Nevertheless the common carotid has been tied with apparent success by a German operator referred to by Farlow,³ by McCarthy,⁴ by Pepper,⁵ and more recently by Dunn.⁶ The last-mentioned case was one of diffuse aneurism following perforation of an undetermined vessel by a circumtonsillar abscess. In the other cases also the precise source of the hemorrhage was not discovered, or else it is not quite clear that the bleeding might not have stopped without the necessity of so radical a measure. Accepting the most unfavorable conclusion justified by recorded experience, we can only reach the opinion that the danger of hemorrhage after amygdalotomy has been greatly overdrawn, and that in the large majority of cases excision is not attended by extraordinary risk.

After all that may be said in favor of other methods and in depreciation of the knife, excision is generally the operation of choice. In tractable cases the knife or scissors may be used with safety, but they have no advantage over a properly-constructed guillotine.

¹ American Journal of the Medical Sciences, April, 1888, p. 357.

² Medical News, Philadelphia, May 28, 1887.

³ Boston Medical and Surgical Journal, March, 1887, p. 303.

⁴ Mackenzie, Diseases of the Throat and Nose, 1880, vol. i. p. 72.

⁵ Druitt's Surgery, 1887, p. 551.

⁶ Transactions of the College of Physicians, Philadelphia, 1891, vol. xiii. p. 61.

The well-known Mackenzie's modification of Physick's instrument (Fig. 5) is by far the best, because of its strength and its simplicity, and because it is safe and efficient. It has no joints or complicated attachments to break or get out of order; it is easily cleaned and prepared for use; with it, if rightly handled, it is impossible to wound parts that should be avoided; and it is possible, in suitable cases, almost to enucleate the tonsil. The secret of success in using it lies in making firm outward pressure against the shaft of the guillotine with the forefinger of the disengaged hand, external

FIG. 5.



Mackenzie's tonsillotome.

support being given by the fingers of an assistant. The object is to remove as much of the tonsil as possible, for two reasons: first, because the stump of a partially-excised tonsil does not shrink to an appreciable degree, but remains as a source of irritation and is prone to recurrences of inflammation, and second, the farther outward the section is made the more nearly we approach healthy tissue in which the divided blood-vessels, although of large calibre, are capable of closing themselves.

There is no danger of going too far out with the guillotine. Between the tonsil and the carotid is a layer of dense connective tissue, beyond which are fibres of the superior constrictor and stylo-pharyngeus muscles, and still farther out is a layer of fascia and adipose tissue. It would be next to impossible to pass the line of safety with a tonsillotome, while with a bistoury it would be quite possible to cut the internal carotid artery, as in cases already mentioned. The addition of transfixion forks to the guillotine, first used by Guersant,¹ is approved by some operators, but is entirely unnecessary. The tonsil may be radically extirpated with the Mackenzie instrument, if properly made and handled.

The original instrument has been modified by its inventor so that the handle may be applied to either side of the shank: the operator may thus use his right hand for either tonsil. It is far better, however, to use the left hand for the right tonsil. If the operation is to be done without an

¹ *Hypertrophie des Amygdales*, Paris, 1864.

anæsthetic, the patient should sit erect facing a window, with his head resting against the body of an assistant, whose hands should steady the head and especially support the tonsil about to be excised. In removing the left tonsil the handle of the instrument is firmly grasped with the right hand: the shaft with the blade open is passed like a tongue-depressor over the dorsum of the tongue back to the wall of the oro-pharynx, turned quickly, so as to bring the fenestra over the tonsil, and pressed firmly outward with the forefinger of the left hand. The presence of the instrument in the pharynx excites retching, which with the pressure brings the ring of the guillotine well down to the base of the tonsil. At this moment the thumb of the right hand drives the blade through the tonsil. The instrument being withdrawn usually brings the tonsil, held by shreds of mucous membrane, in the slot of the ring. Without waiting to check the bleeding, the guillotine is transferred to the left hand, and the right tonsil is removed by a similar process. The whole procedure takes only a few seconds. These minute details are mentioned because this excellent instrument meets with less general favor than it deserves largely because it is often misused. Within the last few months it has happened to me to see a tongue-depressor passed into the mouth of a patient together with the guillotine, and to witness a simultaneous amputation of a uvula and a tonsil. The various so-called improvements and modifications of Mackenzie's tonsillotome are objectionable. The forks, the cup of Lucae,¹ and similar attachments are quite superfluous.

Mackenzie's double tonsillotome for excising both tonsils at the same moment is an ingenious mechanism, but a very clumsy and formidable instrument. It is apt to take off too little of one or the other tonsil. If the operator is ambidextrous he may take a tonsillotome in each hand and remove both glands simultaneously. Such accidents as happened to Schuler and Barré² impress upon us the importance of selecting a well-made instrument. The former broke the ring of a Mathieu instrument, the fragment being promptly removed from the patient's mouth. In the case of the latter the ring knife was broken in two pieces, one of which was extracted, and the other was swallowed and passed per anum three days later. The latter fragment measured two and a half centimetres in length. A similar accident was observed on two occasions by Chassaignac.³ Of course it might be partly the result of extreme hardness of the tonsil, or of the presence of a calculus in its body, as well as of imperfection in the instrument.

As to the use of local or general anæsthesia in removing the tonsils some difference of opinion prevails. Cocaine applied to the surface of the tonsil or injected into it may partially mitigate the pain, but its advantages

¹ Deutsche Medicinische Wochenschrift, Nos. 11 and 15, 1877.

² L'Union Médicale, No. 48, 1886.

³ Dictionnaire de Médecine et de Chirurgie Pratiques, tom. ii. p. 168.

are in some cases counterbalanced by the nausea and other disagreeable symptoms it produces. There may be an objection to cocaine in the increased liability to hemorrhage resulting from the paralysis of the vessels caused by this drug, as suggested in a case reported by Blair.¹ A similar observation has been made by Sajous.² McBride³ says that his experience has not justified such an apprehension; and my own experience with hemorrhage has been limited to some half-dozen cases, in none of which was cocaine used. Chloroform and nitrous oxide may be looked upon favorably, the former on account of its rapidity, the latter on account of its safety. But the former is less safe and the latter is more troublesome to administer than ether. The only objection to ether is the fact that it excites annoying hypersecretion. Practically this is of no consequence, since the anæsthesia should never be profound. Mackenzie asserts that these agents are wholly uncalled for, and maintains that we should have the active co-operation of our patient in preventing the entrance of blood into the air-passages. In the course of a discussion at the Paris Surgical Society, Reclus⁴ referred to an unpublished case of fatal asphyxia caused by the passage of blood into the larynx during a tonsillotomy under chloroform.

The use of chloroform is opposed by Saint-Germain⁵ for two reasons, —because of the danger illustrated in the case just mentioned, and because the operation itself is so quickly completed. Peyrot favors the use of chloroform, asserting that no inconvenience can follow moderate anæsthesia. Among other objections offered to anæsthesia are that there is quite as much of a struggle in giving a child ether as in excising the tonsils without it, and that, the tonsil not being forced into the ring of the guillotine by muscular contraction when the patient is under ether, we fail to remove as much as we should. My answer to these points is that ether should be given in the proper way and in the proper quantity. It is hardly necessary to describe the correct way of administering ether, beyond the simple statement that the child should not be smothered. The majority of children if handled with diplomacy can be etherized without resistance. Occasionally a refractory patient has to be overcome by force, but such a child would be quite as troublesome, and very likely more so, without ether. As to the proper quantity, it should be just enough to keep the patient quiet and abolish conscious sensation, not enough to produce complete muscular relaxation. I maintain that in most cases excision of the tonsils may be done under ether much more comfortably, with equal thoroughness, and with no added risk. No mishap is likely to occur, provided the narcosis is not pushed too far. The reflexes should not be abolished. The patient is placed flat upon his back, a mouth-gag introduced, the tonsils removed in

¹ Albany Medical Annals, February, 1888.

² Transactions of the American Laryngological Association, 1888, vol. x. p. 163.

³ Diseases of the Throat, Nose, and Ear, 1892, p. 49.

⁴ Journal of Laryngology and Rhinology, June, 1887, p. 231.

⁵ Nouveau Dictionnaire de Médecine, etc., vol. ii. p. 159.

quick succession, and the patient turned upon his face to allow the blood to flow out of his mouth. The bleeding ceases in a few moments, and he begins to recover from the small amount of ether inhaled. The time consumed is not much more than would be required in overcoming a child's repugnance to being cut without ether, especially strenuous when it comes to the second tonsil. There should be no hesitation in adopting this method of procedure in children under ten years of age and in older children of nervous temperament. While the advantage of anæsthesia as regards shock to the system is of no little moment, after all its most important recommendation is that it permits us to explore the rhino-pharynx thoroughly and at leisure, and, if necessary, to remove from that region those collections of lymphoid hypertrophy which are so generally associated with enlarged palatal tonsils and which are in reality the cause of most of the subjective symptoms. While the patient is under ether, and before removing the tonsils, it is a very easy matter to make a thorough examination of the pharynx with the forefinger and thus determine precisely the extent and distribution of the lymphoid tissue and the instrument best adapted for its removal. Some operators are in the habit of first clearing out the rhino-pharynx, in order to avoid possible confusion from the presence of clots derived from the bleeding tonsils. Allen, of Philadelphia, states that he often finds it unnecessary to touch the tonsils, as they will shrink after having been relieved of the irritation dependent upon the lesion in the vault of the pharynx. Such has not been my experience. My own preference is to excise the tonsils first, thus gaining more space for subsequent manipulations. After the bleeding has subsided the patient is replaced upon his back, a little more ether is given if necessary, and the vegetations are removed from the pharynx. So small a quantity of ether has been given that the patient begins to recover from its effects almost before the operation is fairly completed, and at no time is blood or débris permitted to enter the larynx. This mode of procedure is believed to be the most humane, as well as the most thorough and exact.

CHRONIC ABSCESS OF THE TONSIL.

Chronic abscess of the tonsil is certainly a rare condition, and might easily be mistaken, as in a case reported by Natier,¹ in which the symptoms simulated those of fibroma. Noquet² describes a case of chronic abscess in the stump of an excised tonsil in a patient twenty years of age, which was opened by an incision parallel with the pillar and was finally cured by means of the galvano-cautery. Similar cases have been seen by Heryng. Garel³ reports three cases of his own, and mentions with others one observed by Grynfeldt.⁴ In his first case the abscess ruptured at the end of a month ;

¹ *Annales de la Polyclinique de Bordeaux*, January, 1889.

² *Journal of Laryngology and Rhinology*, July, 1888, p. 283.

³ *Annales des Maladies du Larynx*, etc., January, 1889.

⁴ *Gazette Hebdomadaire des Sciences Médicales de Montpellier*, No. 34, 1884.

in the second the bistoury was used, but the abscess recurred, and twenty-three days later the galvano-cautery point was applied, followed by tincture of iodine; the third was opened with a bistoury, but suppuration continued until the use of the galvano-cautery. He recommends the use of the galvano-cautery and ignipuncture, especially when excision has failed to dispel a tendency to suppurative inflammation. Two cases of abscess are mentioned by Allen in his paper. One contained only four or five drops of pus, the larger one at least half a drachm. The latter case has added interest from the fact that removal of the cyst together with some tonsillar tissue resulted in the cure of a laryngitis. A case reported by Pasteur¹ presents some interesting features in connection with this subject. It was that of an infant in whom dysphagia and dyspnoea were induced by an accumulation of pus in the tonsil itself and in the surrounding tissues. Relief was given by an external incision. In four months the symptoms recurred, and a similar course of treatment was pursued. It appears that the lesion is of sufficient importance to receive special mention, although doubtless very infrequent. It is so difficult in this situation to get the sense of fluctuation given by purulent collections elsewhere, and inflammatory symptoms may be so entirely absent, that the tumor might readily be mistaken for a neoplasm. In those cases in which the abscess developed in the stump of an excised tonsil, it no doubt resulted from contraction of the mouth of one or more divided crypts. In doubtful cases we may get some light from the use of the exploring needle or from a small incision. The treatment must be that of abscesses in general,—free incision, and irrigation of the cavity with antiseptic solutions. It may be necessary to use the curette, or in obstinate or recurrent cases the walls of the abscess may need to be destroyed with the galvano-cautery.

MYCOSIS OF THE TONSIL.

Tonsillar mycosis is important only from a diagnostic stand-point. It is doubtless often mistaken for follicular amygdalitis or diphtheria. It usually occurs in those predisposed to catarrhal affections, and generally follows "catching cold." It is seldom attended by pyrexia or constitutional disturbance, except such as may be due to an associated inflammatory process. In a case reported by Oltuszewski² the deposit which appeared on the tonsils, palate, and tongue of a patient sixteen years old was accompanied by intense fever. This is very exceptional, although in some cases, according to Hemenway,³ there is decided local irritation. Most patients are in good health, or may be a little run down, and seldom complain of anything more than a slight itching or scratching sensation in the throat. The irritation may be sufficient to excite cough, or even vomiting, but seldom amounts to pain. So slight are the subjective symptoms that in

¹ London Lancet, July 14, 1888.

² Journal of Laryngology, etc., May, 1888, p. 207.

³ Ibid., February, 1892.

many cases the discovery of the affection is quite accidental. Vander Poel¹ recognizes two forms, diffuse and circumscribed. In the former there is a milk-like shiny deposit thick enough to cover and conceal a considerable area. The second form resembles follicular amygdalitis, but there is no congestion. The patches are firmly adherent, and quickly recur if removed. A little blood may follow their forcible detachment, but still it is evident that the membrane or deposit is not incorporated with the tissues, as is the case in diphtheria, but dips down into the glands and follicles, from which it may be removed with somewhat more difficulty than the secretion of a simple inflammation. According to Gautier,² it may be distinguished from diphtheria by the fact that the patches are multiple and never confluent. It may give an odor to the breath; but Hemenway mentions the absence of diphtheritic fetor as a point in differential diagnosis. Its distribution may be very general.

Major, of Montreal, has seen a case in which the deposit could be traced from one tonsil, up the pharyngeal wall, across the vault, down the opposite side, to the corresponding tonsil, and over the dorsum of the tongue, forming a complete ring. A case is described by Nycamp in which it was discovered at the posterior commissure of the larynx, as well as on the tonsil and pharynx. In this case there was slight paresis of the left vocal cord, the relationship of which to the mycosis is not explained.

Cases of mycosis have been reported by B. Fraenkel,³ E. Fraenkel,⁴ Bayer,⁵ and Heryng.⁶ The last observer has collected fourteen cases, six being his own. According to his observation, the local symptoms ranged from mere discomfort to intense pain, dysphagia, and dysphonia. Constitutional disturbance was either absent or extreme. In a case seen by Cohen⁷ at the Philadelphia Polyclinic the lesion followed a rheumatic tonsillitis and the patient lived in an unsalubrious locality where diphtheria was prevalent. He advises the use of the curette or sharp spoon for removing the deposit together with the mucous membrane if necessary, or even ablation of the tonsil followed by thorough cauterization with the electric cautery.

Any doubt existing as to diagnosis may be cleared up by microscopic examination. Vander Poel and Newcomb⁸ agree with most other observers in regarding the deposit as composed largely of leptothrix buccalis and epithelial detritus. Hemenway professes to find another fungus, longer and more slender than the leptothrix: the latter he does not consider characteristic. This bacillus showing a tendency to arrange itself in fascicles

¹ New York Medical Journal, February 9, 1889.

² Revue Médicale de la Suisse Romande, January, 1889.

³ Berliner Klinische Wochenschrift, 1872, S. 94, 1880, No. 18.

⁴ Zeitschrift für Klinische Medicin, vol. iv., 1882.

⁵ Revue Mensuelle de Laryngologie, November, 1882, p. 329.

⁶ Zeitschrift für Klinische Medicin, Bd. iv., H. 4, 1884.

⁷ Pepper's System of Medicine, vol. ii. p. 386.

⁸ New York Medical Record, August 29, 1891, p. 232.

has been called by Fraenkel and Sadebeck "*bacillus fasciculatus*," a term which Hemenway proposes to retain. The microscopic view of a field containing the mycosis product is very striking. Vander Poel describes it as a mass of epithelial cells surrounded by an irregular collection of fungoid spores. Newcomb says that the spores are arranged in link-like processes, varying in length, their ends being rounded or club-shaped, or curled up into fine hair-like filaments. Others are colorless rods with well-defined borders and containing granular matter. Round or oval highly refractive bodies with dark borders are also seen, arranged in colonies, or distributed between the branching spores. Some portions of the stems of the spores may be stained with methyl blue, while other portions remain unaffected. The former are thought to be amyloid in nature, and they give the characteristic starch reaction after having been stained with a solution of iodine and iodide of potassium. Hemenway¹ finds the bacillus of mycosis of somewhat greater length than most observers, and arranged in bundles. The bacilli as he sees them do not show a tendency to form long threads like those of *leptothrix*, and the filaments do not branch like those of the latter; whence he infers that the bacillus of mycosis and that of *leptothrix* are not identical.

The treatment, to be successful, must be radical, and must include all of the deposit, since the fungus shows a capacity for rapid reproduction. Astringents and mild caustics are useless. Baber² cured a case by persistent applications of absolute alcohol, as recommended by Fraenkel, and mechanical removal of the deposit, which was found to contain *leptothrix*.

Oltuszewski treated his case by removing the deposit and gargling with corrosive sublimate one to two-thousand, but fresh colonies of *leptothrix* constantly reappeared. It is the general experience that the galvanocautery is the best means of destroying the fungus. Decker and Seifert,³ who have collected thirty-four cases, find this most efficient. Bonito⁴ precedes the cauterization by curetting. In addition to the cautery, Nycamp used a ten-per-cent. chinoline solution in his case. All the evidence tends to show that mild measures rather stimulate the development of the fungus, which must be thoroughly destroyed.

CALCULI, FOREIGN BODIES, AND PARASITES.

Tonsillar concretions result from obstruction or closure of the mouths of one or more crypts. In the early stage of their formation they are caseous; later on they become harder. They vary also as regards size and situation. They may be no larger than a pea, or they may reach the dimensions of one reported by Lublinski,⁵ which measured two and one-

¹ Medical News, Philadelphia, January 9, 1892.

² Journal of Laryngology and Rhinology, February, 1888, p. 91.

³ Journal of Laryngology and Rhinology, April, 1888, p. 179.

⁴ Thèse de Bordeaux, November, 1887.

⁵ Monatsschrift für Ohrenheilkunde, 1887, No. 10.

half centimetres in length, one-half of a centimetre in thickness, and three-sevenths of a centimetre in breadth, and was composed of phosphate of lime. Délie¹ reports one nearly as large extracted from the tonsil of a girl eleven years of age, while Alderson² has observed one about half an inch long which sloughed out of the tonsil of a patient seventy-two years of age. They may be seen on the surface of the tonsil projecting from a crypt, or they may be deeply embedded. In the latter case they may be discovered by palpation. They may create no disturbance, or they may be the exciting cause of recurrent attacks of amygdalitis. According to Valat,³ a tonsillotomy has been broken by Liégois and by Maisonneuve, the blade striking a calculus, whose presence had not been previously suspected.

The composition of these concretions seems to be extremely variable. For example, Gruening⁴ states that all are composed of leptothrix masses, basing his opinion on the examination of fifty cases. Gautier⁵ also says that calculi may be the consequence or an accompaniment of mycosis. Wurzer⁶ found in a tonsillar concretion, removed from a living subject, sixty-three and eight-tenths parts of phosphorus, fifteen and seven-tenths of carbonate of lime, one per cent. of iron, seven and one-tenth of hydrochloric acid, soda, and some potassa, and a residue of animal matter. Robin found fifty of phosphorus, twelve and one-half of carbonate of lime, twenty-five of water, and twelve and one-half of mucus. The leptothrix elements are doubtless the principal ingredient of small, putty-like balls which are frequently spontaneously expelled from the follicles. A calculus, properly so called, is composed of a small proportion of the fungus and a relatively large quantity of the salts. If the concretion protrudes from the surface of the tonsil it is easy to seize it with forceps and drag it out. It may be necessary first to loosen it by a slight incision. When it lies well within the tonsil a free incision may be needed, or possibly an excision of the gland, best accomplished by means of a stout, blunt tonsil bistoury. In any case the bed occupied by the calculus should be curetted, and perhaps obliterated with the galvano-cautery, in order to prevent reformation.

Foreign bodies in the tonsil comprise in general such slender sharp-pointed bodies as might readily be driven into the substance of the gland by the action of the constrictors. They include pins, needles, bristles, and, in a large proportion of cases, fish-bones.

Mackenzie says that certain individuals seem to have a special propensity for the lodgement of foreign bodies. He attributes it to carelessness in eating, impaired sensibility of the mucous membrane, or some peculiar irregularity of the pharyngeal wall.

¹ *Journal of Laryngology and Rhinology*, April, 1891, p. 344.

² *Ibid.*, September, 1888, p. 349.

³ *Gazette des Hôpitaux*, November 17, 1888.

⁴ *Archives of Laryngology*, No. 3, 1882, p. 136.

⁵ *Revue Médicale de la Suisse Romande*, January, 1889.

⁶ *Ziemssen's Cyclopædia*, vol. vi. p. 971.

Foreign bodies immediately give rise to discomfort by pricking the wall of the pharynx during the act of swallowing, and if long retained may excite suppurative inflammation. The trifling pain which they excite may be referred to the point of lodgement or to a remote region. They may gain entrance to a crypt or may pierce the body of the tonsil. They are sometimes discovered in most unexpected positions, and often cannot be found without the aid of a mirror, or by provoking the act of retching. As an example of the former may be mentioned a case at my clinic, in which, after prolonged search with the mirror, a fish-bone was found sticking into the lower and posterior surface of the tonsil. In another case the foreign body, also a fish-bone, had for several weeks produced a pricking sensation, but had eluded detection. It was finally discovered deeply embedded at the upper and posterior surface of the tonsil, and could be seen only during the rotation of the tonsil on its vertical axis which accompanies retching. In these cases the tonsil is usually hypertrophied. Foreign bodies may generally be removed with forceps without difficulty. Occasionally it may be necessary to cut down upon an impacted body before it can be seized.

Three cases of parasites in the tonsil are referred to by Mackenzie in his treatise. One of hydatid cyst of the left tonsil in a young woman of twenty one, who for eleven months had suffered from attacks of amygdalitis, was related by Dupuytren. The diagnosis of abscess having been made, a bistoury was plunged into the tumor, when nearly two ounces of serous fluid gushed out, and finally a hydatid cyst, the size of a fowl's egg, was extracted. The patient soon after died of erysipelas, and an ovoid hydatid cyst, as large as a child's head, was found attached to the left kidney. A similar case was reported by Davaine, and the same observer reported the third case, which was a trichocephalus lodged in the left tonsil, probably having reached that situation during the act of vomiting.

SYPHILIS OF THE TONSIL.

The number of authentic cases of chancre of the tonsil on record is by no means so large as to have removed this lesion from the field of clinical curiosities. In the most exhaustive review of this subject which has recently appeared, Szadek¹ has collected a series of cases, to which he adds four of his own, in which the diagnosis seems to have been justified by the physical character of the lesions and was confirmed by the usual secondary accidents. Aside from the induration, which is sometimes extreme and again moderate, a tonsillar chancre has no distinctive features. In order to determine the nature of a suspicious sore in this situation we may be obliged to wait for lymphatic engorgement and a cutaneous syphilide, both of which are inevitable. Bumstead² says that chancres of the tonsil are

¹ *Revue de Laryngologie*, etc., April 1, 1891, p. 206.

² *Venereal Diseases*, 1879, p. 475.

never sharply circumscribed; and he is evidently disposed to await developments. Hue¹ observed marked induration of a tonsillar chancre without other characteristics commonly attributed to the primary sore. Donaldson² advises basing a diagnosis upon the history of exposure, glandular enlargement, a period of incubation varying from fifteen days to three weeks, the absence of chancre elsewhere, the duration of the sore, which may be painful but is not attended by febrile reaction, and the outbreak of secondary symptoms, added to the fact that the tonsillar ulcer has developed slowly, has been limited to one side, is superficial, and has a grayish-white surface. He refers to induration as being a somewhat variable symptom, although the most important sign, and depending somewhat on the amount of previous hypertrophy.

In a case described by Pavloff,³ who reports two cases in men and one in a young woman, the induration of the tonsil, which was already hypertrophied, was extreme, and the corresponding submaxillary gland was as large as a hen's egg. Cases have been reported by Iakinovitch⁴ and Zeleneff.⁵ In both the glandular symptoms were conspicuous, and in the latter the tonsil was very large and the induration was as hard as cartilage. Four cases in the same family have been reported by Porai-Koschitz,⁶ the disease beginning with a boy of three years who contracted it from a syphilitic playmate. He transmitted it to a sister a year and a half old, from whom the mother and later the father became infected. In the case of the father the lesion was a somewhat indurated ulcer involving the right tonsil and the anterior pillar, and the preauricular glands on that side were enlarged. A large proportion of cases lately reported have come from Russia, and recent statistics show that of two thousand one hundred and twenty-five cases of syphilis seventy-four per cent. began with extra-genital chancres.⁷ Fournier found one in four hundred and seventy-one cases of chancre in various localities, and one in seventy-seven of buccal chancre, while Desnos found not one in six hundred and seventy-three cases.

It seems to be about equally common in the two sexes. The clinical history of chancre of the tonsil, as given by Taylor,⁸ is as follows. At the outset the gland is red and swollen, but not indurated. In the course of a few days a superficial erosion appears, which soon presents a grayish-white coating irregularly distributed and granular. In the mean time induration has become well marked, and may be even cartilaginous, according to the amount of antecedent hypertrophy.

¹ *La France Médicale*, May 31, 1883.

² *Philadelphia Medical News*, August 15, 1885.

³ *Journal of Laryngology and Rhinology*, September, 1890.

⁴ *Ibid.*, July, 1891, p. 279.

⁵ *Vrach*, 1891, No. 15, p. 386.

⁶ *Journal of Laryngology and Rhinology*, November, 1890.

⁷ *British Medical Journal*, January 5, 1889.

⁸ *New York Medical Journal*, May 24, 1884, p. 577.

Cornil¹ remarks that the diagnosis of chancre of the tonsil presents the greatest difficulties because of the effacement of its characteristics by surrounding inflammation, but, like other authorities, he relies upon the induration, the adenopathy, and the history of special exposure. The mode of contagion includes a great variety of possibilities,—kissing, “abnormal coitus,” smoking, household utensils used in common, surgical instruments, and so on. Epidemics of syphilis among glass-blowers were observed and described by Rollet in 1858, and later by Guinaud.² These cases become most perplexing when there is no history of exposure, when the confirmatory symptoms are unusually delayed, and when the primary lesion tends to assume a phagedænic character. Under such circumstances the ulcer might readily be mistaken for cancer, as in the case reported by Merklen.³ The advanced age of his patient (sixty-four) was also misleading. In a case reported by Roddick,⁴ a deep and extensive ulceration of the tonsil, with irregular edges and covered with grayish secretion resembling in places false membrane, and accompanied by swelling of the submaxillary gland, was thought to be an epithelioma. An amended diagnosis of chancre was confirmed by the appearance of secondary phenomena. In cancer all the symptoms rapidly increase in severity, especially the odynphagia and the lancinating pain in the ear, and the sensitiveness of the glands. Hemorrhages are apt to occur, emaciation and cachexia supervene, and there is no response to treatment. All these points are in rather marked contrast with syphilis of the tonsil. The most common syphilitic lesion observed on the tonsil is the mucous patch, which is always associated with other symptoms which leave no doubt as to its character. It is very apt to be preceded or accompanied by an erythema involving the velum, which offers no distinctive features, except that the hyperæmia is rather less intense than that of a simple angina and does not shade off into the adjacent mucous membrane, but is limited by a distinct line of demarcation. The patches themselves at the outset are quite superficial, have an irregular outline, and are of a grayish-white color, such as might follow a pencilling with nitrate of silver. From this color they have been called “opaline patches.” The original character of the lesion is soon lost in consequence of the friction to which the tonsils are particularly exposed in deglutition, and a considerable ulceration may result. Until the latter condition is reached, mucous patches may exist in large numbers without giving the patient any inconvenience.

Syphilitic ulcerations of the tonsils may be superficial or deep, in the latter case being the consequence of disintegration of a gummatous infiltration. They are always of a serious nature, because of the pain they produce, but especially on account of their liability to involve adjacent parts. In case the velum and the pillars are invaded, distorting cicatrices

¹ Syphilis, translated by Simes and White, 1882, p. 96.

² Syphilis des Verriers, Lyon Médical, 1880, pp. 547–589.

³ Annales de Dermatologie et de Syphiligraphie, 1881, vol. ii. p. 673.

⁴ Canada Medical and Surgical Journal, 1879–80, p. 490.

and adhesions are likely to result, which lead to permanent impairment of function. It may be said that an overwhelming percentage of true ulcers of the tonsil is syphilitic. It is only with very extensive gummatous ulceration that confusion in diagnosis may arise on account of its resemblance to cancer. In such cases careful investigation and tentative specific treatment will speedily resolve the doubt. An ulcerating gumma of the tonsil is said by Juhel-Renoy¹ to look at times like a diphtheritic or a scarlatinal angina by reason of its development being less insidious than that of similar lesions originating in the soft palate. The treatment of these lesions is very simple and satisfactory. The chancre requires no local treatment unless it becomes phagedænic, when the best application is the acid nitrate of mercury, the parts having first been cleansed and anæsthetized with cocaine. Appropriate internal medication must also be prescribed. Repair of the later lesions is decidedly hastened by local treatment. Mucous patches generally disappear in a few days under the use of strong solutions or the solid stick of nitrate of silver or chromic acid in ten-grain solution combined with mercurials internally. Recurrences are frequent. A carbolyzed alkaline gargle is a grateful detergent, and may be useful if there is much swelling or erythema. A similar course is indicated in ulcerative lesions, but needs to be much more energetic, especially if the surface is inclined to be sloughy or covered by offensive secretion. The fetor which is here apt to be so annoying a symptom may be corrected and the healing of the ulcer stimulated by insufflations of aristol, either alone or combined in equal parts with stearate of zinc. In the combination the powder seems to remain longer in contact with the surface. It is in these cases that the most brilliant results are obtained with iodide of potassium pushed to the point of tolerance. The initial dose should be five grains, unless the symptoms are urgent or the patient is already habituated to the drug, given in Vichy water or milk. Tonics may be indicated, and sometimes mercurials are valuable, especially in cases whose early treatment has been neglected.

Specific treatment may receive valuable assistance from the use of tonics, cod-liver oil, etc., especially in the so-called tertiary lesions and in patients whose constitutions have been weakened by excesses, neglect, or hardship.

TUBERCULOSIS AND LUPUS.

Clinically the contrast between tuberculosis and lupus is very striking. The former is prone to involve the tissues of the air-tract from the lungs upward, while the reverse order is characteristic of lupus.

Neither of these lesions is found primarily in the tonsils: the former succeeds to pulmonary tuberculosis, the latter occurs by extension from adjacent mucous membrane. The old idea that lupus of the mucous mem-

¹ Archives de Laryngologie, May, 1889, p. 129.

brane never develops independently of a similar cutaneous lesion has been corrected by modern observation. In a case of lupus reported by Asch¹ there were no external manifestations, although the lesion involved the right tonsil, together with the anterior pillar and the roof of the mouth, which were studded with numerous fleshy tubercles and nodular masses. The free border of the velum and the posterior pillars were ulcerated and the left anterior pillar was thickened. Several similar cases are on record, among them one by F. I. Knight,² in which the cutaneous lesion appeared a year or two after the first appearance of trouble in the fauces. Lublinski³ states that primary tuberculosis of the tonsil has never been seen in man, although it has been observed in animals fed on tuberculous material. The histological difference between these two processes is not very pronounced. It seems to be one rather of degree. For example, in lupus we find greater vascularity, fewer areas of coagulation necrosis, and the giant cells are less numerous. As regards bacilli, it is a well-known fact that it is difficult, if not impossible, to discover them in lupus. On the other hand, Delavan⁴ says that their absence in cases of tuberculosis is not uncommon. He examined the scrapings from a tubercular ulcer, and found a large amount of fine granular matter, abundance of tubercle-cells and occasional giant cells, some of the fibrous tissue of the tonsil, and epithelium. He found but few pus-cells, and no bacilli. He admits that the latter result may have been due to faulty methods of examination. It appears, then, that we must rely in the main upon the mode of evolution of the lesion, in case pulmonary signs are indefinite.

It may be, as suggested by Wright,⁵ that lupus is a modified form of tuberculosis. If their identity should ever be proved, the term lupus must still be retained to describe a distinct clinical condition. The duration of lupus is much greater than that of tuberculosis. Johnston⁶ presented a case to the American Laryngological Association in 1888 in which the disease had existed about four years.

The tendency of the lesion in lupus is obviously more benign: the ulceration is more superficial and its repair more easily accomplished, spontaneous cure being not very infrequent. There is very grave doubt of the spontaneous healing of a genuine tubercular ulcer; although cases of the kind in the larynx have been reported.

In tuberculosis the ulcerated surface is uneven, pale, granulated, and covered with yellowish-gray, viscid mucus. Its edges are sharply cut, sometimes levelled, but never undermined. The ulcer is usually ovoid in shape, rather superficial, and has little or no surrounding induration. It

¹ Transactions of the American Laryngological Association, 1881, p. 16.

² *Ibid.*, p. 12.

³ British Medical Journal, August 27, 1887.

⁴ Reference Hand-Book of the Medical Sciences, vol. vii. p. 128.

⁵ Philadelphia Medical News, January 9, 1892, p. 12.

⁶ Transactions of the American Laryngological Association, 1888, p. 204.

is apt to be quite painful, but the pain is by no means so severe as that of a malignant ulcer, although more pronounced than that of lupus. In the two cases narrated by Lublinski the tonsillar lesion was secondary to pulmonary tuberculosis. The ulcers were the size of a lentil, with whitish bases, and red and slightly-raised margins. A most careful study of this subject by Dmochowski¹ gives some interesting data. His observation included fifteen cases, ranging in age from eighteen to fifty-six years. In every case the lesion was secondary to pulmonary tuberculosis. In five the larynx was involved and there were small ulcerations of the pharynx. In one there was also nasal tuberculosis, and in ten there were similar lesions of the glands at the base of the tongue.

He formulates the following conclusions. (1) Secondary tuberculosis of the tonsil is frequent, if not constant, in pulmonary tuberculosis. Strassmann, in Cohnheim's laboratory, found it in thirteen out of twenty-one fatal cases. (2) Similar lesions of the lymphoid tissue at the base of the tongue are very common. (3) Infection seems to take place from the oral cavity, since the tonsillar lesion occurs only when the tuberculosis is primary in the respiratory tract. (4) The bacillus appears to penetrate the crypts of the tonsils and the follicles at the base of the tongue, producing in the first instance superficial changes which gradually become deeper. (5) Ulceration may occur, always confined to the crypts and never on the free surface of the tonsil. (6) Caseous disintegration may lead to the formation of cavities. (7) No gross lesion may be apparent during life. The glands may be a little large, sometimes soft and succulent, at other times shrunken, hard, and dry. (8) The tendency to intra-cryptous ulceration may be explained by supposing that the microbe finds more favorable conditions in that situation. The diagnosis of tuberculosis must depend in general upon the co-existence of pulmonary disease. Regarded by itself, it might be mistaken for syphilis, or for the early stage of a malignant process. Its tardy evolution, its comparative painlessness, its relatively superficial situation, and its freedom from induration, taken in connection with the general pallor of the mucous membrane and the obvious indications of lung-trouble, will help us to reach a correct conclusion. The element of pain in all faucial ulcerations is extremely variable. In a case reported by Bean,² a tubercular ulceration beginning in the tongue and extending back to the tonsil and the wall of the pharynx was excessively painful during the act of swallowing. In discussing the foregoing case, Delavan mentioned one of ulceration at the tip of the tongue which was remarkable for the entire absence of pain. In a case of tubercular ulcer of the base of the tongue under my own observation many years ago, the pain was so acute that the patient refused to eat, and was actually dying of inanition as much as of the disease. In a more recent case under my care, of ulceration at the

¹ Saigous's Annual, 1890.

² Transactions of the American Laryngological Association, 1889, p. 114.

upper border of the tonsil, the patient suffered the most excruciating pain on every attempt to swallow. Fortunately, we have in cocaine an agent which will in great measure relieve such agony.

As to further treatment, the energy of our attack should be governed by the general condition of the patient and the extent of the local manifestation. If the latter is somewhat limited and the patient is fairly well sustained, we should be justified in attempting to destroy the tubercular deposit by thorough curetting followed by application of lactic acid fifty to one hundred per cent., or by the use of the galvano-cautery. The violence of the reaction may be controlled by applications of carbolic acid one-half drachm in one-half ounce each of glycerin and water once a day, or by hourly applications of menthol one-half drachm in one ounce of water.

In the majority of cases palliation is all that we are authorized in undertaking. Should a case of primary tuberculosis of the tonsil present itself, it would certainly be proper to treat it by radical extirpation. Lennox Browne enumerates the indications for treatment as follows: (1) To counteract the general phthisical processes. He considers the hypophosphites and extracts of malt especially serviceable in pharyngeal tuberculosis, and expects good results from cod-liver oil if it is well borne. (2) To give as much as possible functional rest, by disuse of the voice and by using the œsophageal feeding-tube as first advocated by Delavan. The tube should be of small calibre, and its introduction should be preceded by an application of cocaine. (3) To relieve the pain in swallowing. (4) To administer suitable nourishment. The food should be soft and thickened, and may be taken a few minutes after an application of cocaine in five- or ten-per-cent. solution. When the effect of the cocaine seems to be exhausted after long-continued use, a preparation of compound tincture of benzoin, compound tincture of camphor, of each one ounce, tincture of belladonna one drachm, mixed with yolk of egg, will be found satisfactory, or ten to thirty grains of zinc chloride, with eight grains of morphine hydrochlorate in half an ounce each of glycerin and water. (5) To heal the ulceration. He thinks well of lactic acid after the use of the curette, as extolled by Krause and others, and of menthol, as recommended by Rosenberg, and a recent experience leads him to recommend with confidence the galvano-cautery, which has antiseptic and healing properties not possessed by any other form of actual cautery. He appears to be not over-sanguine as to the ability to heal tubercular ulcers, and relies chiefly on palliative measures.

Isambert, who looks upon the tubercular as the most painful of pharyngeal ulcers, has had some benefit from glycerate of morphine.

Maekenzie recommends insufflations of acetate of morphine, one-fourth to one-half grain twice daily, mixed with powdered starch. Hot sedative inhalations of benzoin, hydrocyanic acid, or creosote may at times be serviceable. In extreme cases the feeding-tube or nutritive enemata may be necessary. The outlook in these cases is absolutely hopeless; yet we must

exhaust every resource to prolong the life of our patient and mitigate his suffering.

Lupus of the tonsil always occurs by extension from the velum or the palatal folds. It is an extremely rare lesion, and the diagnosis will usually have to be made by exclusion. It is now established beyond question that lupus of the mucous membranes may exist without external manifestations, the latter phenomena not appearing for a considerable interval. Cases in point have been observed by Lennox Browne and others. Reference has already been made to the histological similarity of lupus and tuberculosis. Koch,¹ Neisser,² and others maintain their identity, while Kaposi,³ Schwimmer,⁴ Campbell,⁵ and others are equally convinced of their discrepancies. Baumgarten, who believes them to be separate and distinct lesions, bases his belief on the following points of difference observed in conjunctival tuberculosis: (1) caseous necrobiosis, a characteristic of tuberculosis, is always absent in lupus; (2) the formation of epithelioid cells is less conspicuous in lupus; (3) giant cells are strikingly more numerous in lupus; (4) the vascularity of the lupus nodule is more marked; (5) in the older portions of the lupus neoplasm there is an increased formation of spindle-shaped elements, the patch finally assuming the appearance of recent cicatricial tissue; (6) in lupus the miliary structure is subordinate, the infiltrations representing rather an irregular net-work with thickened nodal points; (7) finally, the lupus granule has a capacity for suppuration not possessed by tubercle.

Neisser believes that lupus is a partial manifestation of tuberculosis, the latter being more acute in course and of higher degree. Lupus has been called by Marty⁶ an "attenuated tuberculosis."

In a most interesting paper by Rice,⁷ who inclines to a belief in the identity of these lesions, after a consideration of the subject in general and the report of a case of lupus of the larynx and pharynx, the following conclusions are offered: "(1) that the discovery of the tubercle-bacillus in lupus nodules and the demonstration that artificial tuberculosis can be produced by the injection of a bacillar culture obtained from lupus tissue are strong proofs of the identity of lupus vulgaris and tuberculosis; (2) that lupus of mucous membranes is of the same histological formation as cutaneous lupus; and as the tubercle-bacilli have been found in lupus of the throat, this disease probably bears the same relation to general tuberculosis as does lupus of the integument; (3) that we believe lupus of the throat to be a chronic localized tubercular process, while ordinary tuberculosis of

¹ Quoted by Lennox Browne, p. 430.

² Ziemssen's *Hand-Book of Diseases of the Skin*, 1885, p. 281.

³ Quoted by Lennox Browne, p. 430.

⁴ Ziemssen's *Hand-Book of Diseases of the Skin*.

⁵ *Lupus*, etc., London, 1886, p. 10.

⁶ *Le Lupus du Larynx*, Paris, 1888.

⁷ *New York Medical Record*, April 18, 1891.

the larynx is an acute or subacute general tubercular process; (4) that lupus upon mucous membranes occurs in about twelve per cent., or one-eighth, of all cases of lupus vulgaris; (5) that the diagnosis of laryngeal lupus is not difficult, because it usually is accompanied by lupus of the skin; (6) that in primary lupus of the larynx the two most important factors in diagnosis are the discovery of the tubercle-bacillus and the effect of the injections of parataloid on the disease; (7) that while marked benefit has been derived in the case of lupus laryngis, which forms the basis of this paper, we must wait longer before deciding whether the large hopes which have been entertained by the medical profession, of curing lupus and tuberculosis by the Koch method of treatment, are to be realized." Whatever may be the final outcome of the controversy, it is very certain that in lupus the clinical history is much more prolonged and the prognosis is much more favorable than in tuberculosis.

The description given by Lefferts¹ of the pharyngeal appearances in a case of lupus of the larynx is sufficiently graphic. In the first place, there was a good deal of thickening of the parts involved, and they were studded with fleshy granulations, nodules, or tumefactions which gave a very irregular contour. Here and there were small white points, patches denuded of epithelium, and small *worm-eaten* ulcerations. He considers that there is no difficulty in differentiating lupus from syphilis, while Gottstein says that it more closely resembles syphilis than tuberculosis. Should any doubt remain after careful examination of a given case, it may be dissipated by tentative use of mercury, which is promptly and positively harmful in lupus. In a case described by De la Sota y Lastra,² mixed treatment was on two occasions undertaken, but was at once given up, owing to its obvious bad effects upon the lesion, which was very extensive, in part ulcerated, and was not attended by external manifestations. This author calls attention to certain features of lupus which may be of diagnostic value. He has met with it oftener in men than in women, and at any period of life, it not being limited to early life, as maintained by Hebra. He has found no evidence of heredity, except as regards the possible predisposing influence of scrofula, syphilis, or rheumatism. He has been unable to discover that personal habits or any local agencies had anything to do with its development. The tubercles may be scattered or grouped, but always remain distinct. They are very red in color, and present an elastic resistance to palpation. They are harder than inflammatory infiltration and less hard than epithelioma. The affected parts are not abnormally sensitive until after the tubercles have softened and become ulcerated. Sometimes the ulcerations are very superficial, at other times they are very extensive and destructive. The ulcers sometimes develop slowly, and again with astonishing rapidity. The propensity of syphilis to attack the bony

¹ American Journal of the Medical Sciences, 1878, vol. i. p. 372.

² Transactions of the American Laryngological Association, 1886, p. 11.

structures is by no means frequently, if ever, displayed in lupus. The reparative action may begin without warning in the midst of a steadily progressive disintegration of tissue and proceed with even more remarkable speed than the process of destruction. The cicatrix is very uneven and red; that of a syphilitic ulceration is white, radiated, and depressed. In spite of the most careful scrutiny and an observance of the most detailed directions for identifying lupus, it must be admitted that its phases are variable, and its similarity to tuberculosis and syphilis is often so close that the diagnosis is a very perplexing problem.

In his article on tuberculosis of the pharynx, Bosworth groups the prominent characteristics of three forms of ulceration which may be confounded:

SYPHILIS.	PHTHISIS.	SCROFULA.
Deeply excavated.	No apparent excavation.	No excavation.
Deep red, angry-looking areola.	No areola.	No areola.
Sharp-cut edges.	Somewhat irregular, not sharp-cut.	Everted and raised edges.
Well-marked line of demarcation.	Line of demarcation not distinct.	Line of demarcation well shown.
Yellow purulent discharge.	Grayish, semi-opaque, ropy mucous discharge.	Muco-purulent discharge.
Profuse discharge.	Slight discharge.	Slight discharge.
Rapidly destructive.	Moderately active destruction.	Very slowly destructive.
Erodes deeply.	Extends laterally and superficially.	Extends very slowly and in all directions.
No general dyscrasia.	Marked general dyscrasia.	Strumous habit well marked.
No fever.	High fever.	No fever.

Browne subscribes, with certain modifications, to this grouping, but does not recognize scrofulous ulcers as a distinct lesion.¹ In addition, we have the general history of the patient and of his family. Moreover, the external glands are often swollen and painful in tuberculosis, whereas in that stage of syphilis when a deep throat-ulceration is likely to occur, glandular enlargements are not commonly present. The possible coexistence of syphilis and tuberculosis should not be ignored. There may be some resemblance to malignant disease, as regards the state of the glands as well as the ulceration itself, which may be cleared up only by close study and observation. With diphtheria there can hardly be any possibility of confusion, provided ordinary care be taken. Browne adds to the differential points between syphilis and tuberculosis the fact that in the former the granulations on the surface of the ulcer are few and highly inflammatory, while in tuberculosis there is much indolent granulation. The granula-

¹ In a recent edition of his treatise on Diseases of the Nose and Throat, Bosworth has dropped scrofula from his table of differential diagnosis.

tions may reach considerable size, amounting almost to polypoid overgrowth.

The treatment of lupus is of doubtful value, or, to put it otherwise, it may be pursued faithfully for a long time without the slightest apparent effect, when suddenly cicatrization may begin and proceed to complete healing within a few days. In patients in depressed health, tonics, cod-liver oil, and so on, seem to be of some assistance. In others, large doses of arsenic appear to do good. No specific for lupus has yet been found. Local treatment is in favor with some and is condemned by others. Asch used four hundred and eighty grains of nitrate of silver to the ounce of water with benefit. Lactic acid has been used with success. Bean¹ has no confidence in it, and advocates thorough curetting followed by the use of the galvano-cautery or the Paquelin cautery. De Blois² has found nothing so soothing as iodoform, although in none of his cases did the ulcerations heal.

BENIGN TUMORS.

Benign tumors of the tonsil are generally papillomatous in structure. They may be productive of no subjective symptoms, or they may give rise to a tickling sensation in the fauces which is the exciting cause of a hacking, irritative cough. When they reach a considerable size, they cause the symptoms which would naturally follow an obstructive lesion. Papillomata are always painless, usually pedunculated, and may vary in size from that of a pea to a diffuse mass involving the pillars and the velum. When they assume the latter form they show a tendency to recurrence. In the case of a girl, aged thirteen, seen by Morgan,³ the growth had been twice removed. At the time of the report it was of the size of a small egg. In a case under my own care the neoplasm, which invaded the anterior surface of the right tonsil and the anterior pillar, was to all appearance thoroughly destroyed with the galvano-cautery. Within three months signs of return were plainly visible, and the cauterization was repeated. Papillomata are generally multiple, or they may hang, like a bunch of grapes, from a single pedicle. In the former case the use of the galvano-cautery is probably the best resource; in the latter, the growth may be very easily removed with scissors or with the wire snare, either hot or cold. The gross appearance of a papilloma may be like that of a supernumerary tonsil, a condition which has been carefully studied by Carroll Morgan.⁴ Its real character can be determined only by the microscope.

Lipoma of the tonsil is a most rare condition. The case reported by Atkinson⁵ is almost unique.

An equally unusual lesion is angioma varicosum, as exemplified in the

¹ Transactions of the American Laryngological Association, 1889, p. 115.

² Ibid., 1884, p. 104.

³ British Medical Journal, March 9, 1889, p. 533.

⁴ Transactions of the American Laryngological Association, 1889, p. 4.

⁵ Edinburgh Medical Journal, August, 1873.

case reported by Keimer.¹ The left tonsil, the soft palate, and the anterior palatine fold were involved. A cure was effected by electro-puncture.

Fibroma of the tonsil is much more common, and may develop from the circumtonsillar connective tissue or from that of the gland itself. Delavan² suggests that fibrous tumors may be degenerated supernumerary tonsils which have acquired a fibrous character as a result of the irritation to which they are exposed. They grow very slowly and painlessly. In the case reported by Lefferts³ the tumor reached such a size as seriously to interfere with breathing and swallowing, before the patient sought relief. It occurred in a man aged fifty-five, who for many years had been aware of its existence. It projected from the right tonsil almost to the opposite side of the fauces. It was somewhat pedunculated, and was not vascular. It was removed by Beebe with the wire *écraseur* and without hemorrhage. As regards dimensions this case finds a counterpart in one reported by Lannois,⁴ in which the pharynx was nearly filled by a pedunculated fibroma. A very interesting case of fibro-cellular tumor of the tonsil, reported by Fitzgerald,⁵ measured two and one-quarter inches in length, one inch and three-quarters in breadth, and one inch and one-half in thickness. The removal of fibromata is free from difficulty or danger. Being usually constricted at their base, they may be readily engaged in the loop of the wire snare, or, if preferred, the pedicle may be divided with scissors, as was done in the case reported by Lublinski.⁶

In this connection that remarkable case of fibro-enchondroma of the right tonsil reported by Chiolini⁷ should be referred to. The tumor, which was as large as an orange, was removed by Bottini. After incision of the mucous membrane, enucleation was accomplished by means of the finger and traction with forceps.

A few cases of cystoma of the tonsil are on record. In some the cyst has been disclosed by an operation for hypertrophy. In others the cyst was on the surface of the tonsil.

According to Allen, this lesion is described by Rokitansky, in his *Pathological Anatomy*, and by Virchow, in his work on tumors, as having been detected in the dead subject. Allen himself has met with it in dissection, and in a recent case in the living subject a cavity the size of a small chestnut was opened by excision, a quantity of glairy fluid escaping at the moment. Microscopical examination of the former case showed slight increase of the connective tissue between the follicles, and a conversion of the crypts themselves into large, irregular, star-shaped cavities, evidently

¹ *Deutsche Medicinische Wochenschrift*, No. 33, 1887.

² *Transactions of the American Laryngological Association*, 1889, p. 8.

³ *Ibid.*, 1889, p. 62.

⁴ *Lyon Médical*, November 4, 1888, p. 326.

⁵ *Australian Medical Journal*, September 15, 1880.

⁶ *Annales des Maladies de l'Oreille et du Larynx*, December, 1889.

⁷ *Gazzetta degli Ospitali*, Feb. 15, 1885, p. 98.

resulting from occlusion of their orifices. The symptoms to which it gives rise are not of much moment, although in a case referred to by Cohen a condition of nervous aphonia was apparently cured by removal of a tonsillar cyst, a wedge-shaped mass, including the cyst-wall, being cut out. The contents of these cysts are usually caseous. They may be obliterated by emptying them by a free incision and applying to their interior almost any agent that will excite adhesive inflammation.

A very interesting pathological condition of the tonsil is seen in lymphadenoma, one of the phenomena of the so-called Hodgkin's disease. It is, of course, merely one element in a general disease of the lymphatic system, and its importance may be subordinate. The diagnosis may be difficult until the symptoms become well established. In a case recorded by Villar,¹ the lesion was supposed to be malignant, after the failure of antisyphilitic treatment.

The tumefaction of the cervical glands finally may become so extreme as to threaten asphyxia and necessitate tracheotomy. An excellent account of a case of this kind has been given by Lennox Browne.² His patient was a woman of forty-eight, who had been troubled with dysphagia for two years. There had been progressive paleness, but no loss of flesh. Her mother had died of a similar disease. The left tonsil was converted into a large, smooth, red tumor, tense but not very painful, resilient but not fluctuating. The right tonsil was also enlarged, but was ragged, and looked like ordinary hyperplasia. Several enlarged glands were found in the neck and in the axilla. The thyroid seemed to be atrophied, and the spleen was not enlarged. Masses aggregating in weight nearly four hundred grains were removed with the wire snare. A microscopic examination made by Wingrave gave the following result. The growth consisted of small round cells embedded in a matrix for the most part homogeneous. The protoplasm of the cells was scanty as compared with the size of the nucleus, a characteristic of lymphoid cells. In part the arrangement and structure distinctive of tonsillar tissue were visible.

A case reported by Kendal Franks³ is one of unusual interest, because of the extraordinary difficulty in diagnosis. The patient, a man of forty-six, had enormous enlargement of both tonsils, adenoids in the vault of the pharynx, and general adenopathy. The swelling of the glands had been noticed since a fall from a horse three years before. The diagnosis of sarcoma had already been based on microscopical examination of a small portion of one tonsil. This diagnosis was questioned, owing to the symmetrical enlargement of the tonsils and the general lymphadenitis. The tonsils were removed and the rhino-pharynx scraped under chloroform, tracheotomy being required in the midst of the operation. The patient derived great relief from the operation, but of course the general gland-disease

¹ Bulletin de la Société Anatomique de Paris, March 2, 1888.

² Journal of Laryngology and Rhinology, July, 1891.

³ Ibid., January, 1891.

progressed towards a fatal termination. At the time of the report, seven months having elapsed, the patient was slowly sinking from exhaustion.

In commenting on the foregoing case, Sir Morell Mackenzie¹ mentioned a similar one in which most excellent results followed interstitial injections of acetic acid, the growth of the tumors being arrested. The patient had previously been operated upon several times, and objected to further cutting. The diagnosis is evidently quite uncertain, at least in the early stages, especially since the microscope is so misleading. The single feature whereby we may be able to distinguish the condition from myxo-sarcoma consists in the tendency of the latter to infiltrate contiguous structures. The treatment of lymphadenoma of the tonsil need not be active until the tumor begins to cause annoying impediment, when it may be removed with the snare or the knife. The results with acid injections are encouraging. The constitutional state, of which it is simply an index, may be palliated or modified by suitable internal medication.

MALIGNANT DISEASE OF THE TONSIL.

Malignant disease of the tonsil is, happily, not frequent.

Mackenzie states that "out of eight thousand two hundred and eighty-nine deaths from cancer recorded in the Paris registers, three were ascribed to cancer of the tonsils."

Lennox Browne² has seen only twelve cases in twenty years, or about one in five thousand of throat-disease. In his experience also the growth has always been primary. Mandl³ and a few others assert that it may be secondary. Browne admits that the tonsil may be invaded by disease beginning in the tongue or in neighboring parts, but in the usual acceptation of the term this is not what is meant by "secondary." Holger Mygind⁴ maintains that primary sarcoma is rare, having been able to find only four cases among thirty thousand surgical cases at the Copenhagen Hospital. On the other hand, Wolfenden⁵ believes that sarcoma of the tonsil in general is not so rare as might be inferred from the number of recorded cases. A similar opinion is held by Newman,⁶ who has met with ten cases in seven years and has discovered a considerable number scattered through medical literature.

According to Butlin,⁷ the two most common forms are round-celled sarcoma and epithelioma. They are equally fatal, but present certain differences in clinical history and in local characteristics which render them, as a rule, easily distinguishable. While the former may be met with at almost

¹ *Journal of Laryngology and Rhinology*, January, 1891, p. 26.

² *Diseases of the Throat*, 2d ed., p. 259.

³ *Maladies du Larynx*, etc., Paris, 1872.

⁴ *Journal of Laryngology*, etc., August, 1890.

⁵ *Ibid.*, etc., October, 1889.

⁶ *Malignant Disease of the Throat and Nose*, 1892.

⁷ *The Operative Surgery of Malignant Disease*, 1887.

any age, the latter seldom occurs before middle life. The former exists as a round smooth tumor which eventually may ulcerate to a greater or less depth. The disintegration of an epithelioma takes place quite early in its development. For this reason pain is an early and prominent symptom in the latter disease. It is present to a somewhat slighter degree in sarcoma. In a case of sarcoma not very long since under my own observation, although the cervical glands were enlarged and the tumor of the tonsil was as large as a walnut, pain was not very marked until ulceration began. The chief complaint was of dysphagia. Infiltration of the glands and dissemination of the disease are apt to occur early, but may be postponed for several months. The course of either disease is steadily progressive unless arrested by surgical interference. In MacCoy's¹ case of sarcoma, however, there were periods of quiescence. Sarcoma seems to be more common in males than in females. For example, Gray² has collected nineteen cases, thirteen of which were males.

The diagnosis of malignant disease of the tonsil in its early stage is often very difficult. A case of sarcoma reported by Croly³ began like an ordinary tonsillitis, the swelling so closely resembling an abscess that an explorative puncture was made. Wolfenden's case was quite similar. Gray's case also began as a simple swelling of the tonsil which soon broke down, and MacCoy's like a mild tonsillitis.

As the case advances, all doubt disappears, except that the ulcerative stage of cancer may resemble syphilis, especially if the glandular infiltration is not pronounced and a history of venereal infection is obtainable. In general the diagnosis of carcinoma may be based on the age of the patient, this lesion being restricted to advanced life; sarcoma, as said before, may occur early in life: on the existence of pain, lancinating in cancer, of a duller character in sarcoma, and of sensitiveness to pressure upon the tumor itself and externally at the angle of the jaw: on the fact that but one tonsil is enlarged: on the gradual increase of the growth, and of the ulceration, with extension of the inflammatory areola. Finally, microscopic examination may give confirmatory testimony, more trustworthy, however, in epithelioma than in sarcoma. In cases simulating abscess an explorative incision will give exit to bloody fluid but no pus. An instructive tabulation of the comparative symptoms of syphilis and cancer, both epithelioma and sarcoma being included in the latter term, is given by Lennox Browne:

SYPHILIS.

Functional Symptoms.—Swallowing difficult, but never impossible, though occasionally leading to return of fluids through the nostrils: the sensation is essentially one of

CANCER.

Functional Symptoms.—Dysphagia, as it is the first, is also the prominent symptom, and increases in severity so as to lead to total inability to take food. Acute lan-

¹ Philadelphia Medical News, February 2, 1889.

² International Journal of the Medical Sciences, February, 1889.

³ Journal of Laryngology, etc., July, 1887, p. 270.

discomfort rather than pain, with entire absence of pain when the parts are at rest.

Physical Signs.—The tonsils are generally affected by syphilis in its earlier (secondary) stages by deposits on their surface of mucous patches: in the advanced stages (tertiary) syphilis attacks the glands as a perforating ulcer. There is but slight sympathetic glandular enlargement, which is not painful, and subsides with the cause of the irritation.

Hemorrhages are rare.

Emaciation, if existing, is only in proportion to diminished nutriment taken.

Therapeutic.—Most amenable to appropriate treatment.

cinating pain is a prominent and almost constant symptom.

Physical Signs.—Cancer, whatever the form, is always manifested in the tonsils as a new growth, which attains considerable size before the occurrence of ulceration. There is considerable infiltration and induration of neighboring glands, which become as painful as the primary seat of the disease.

Hemorrhages are frequent and profuse, and are often the immediate cause of death.

Rapid emaciation commences long before dysphagia is by any means extreme, and advances even with relief of symptoms.

Therapeutic.—Advances in spite of every measure, medicinal or surgical.

The prognosis is invariably bad, for the reason that except in very rare cases the disease has become generalized before the tonsil is attacked. Death may occur from inanition, cachexia, hemorrhage, or possibly from cedema of the larynx, as in the case reported by Browne, whose patient, a man of forty-four, had an immense mass of induration in the neck associated with malignant ulceration at the base of the tongue. (Edema of the epiglottis and left ary-epiglottic fold produced sudden fatal asphyxia. In addition the left recurrent laryngeal nerve was found embedded in the mass of induration, and there was atrophy of the left posterior crico-arytenoid muscle. The first two causes mentioned are by far the most frequent, although several cases of death from hemorrhage are on record. In a case reported by MacIntyre,¹ a severe hemorrhage took place from the lower border of the right tonsil, which was finally checked by means of the thermo-cautery. This case is also of interest as illustrating the not infrequent conflict between the microscope and the clinical history. The former pronounced the lesion a carcinoma, but the growth looked like a melanotic sarcoma. The subsequent development of multiple black nodules in the skin, with swelling and tenderness of the liver, would bear out the latter diagnosis.

From what has been said of the tendency and the characteristics of malignant disease in this situation it is apparent that only in very few exceptional cases is anything more than palliative interference justifiable or in the least degree promising. An external operation is the only one in most cases that gives the least hope of radical extirpation, and that is a very serious measure, not only from the difficulties of the operation, but also from possible secondary accidents, such as pneumonia and hemorrhage.

Of twenty-three cases collected by Plicque,² death supervened in nine.

¹ *Journal of Laryngology, etc.*, October, 1891, p. 412.

² *Annales des Maladies du Larynx, etc.*, April, 1889.

The risks are somewhat increased by the preliminary tracheotomy which is necessary in the external operation, and if a superficial operation through the mouth is to be undertaken it is essential to be prepared to open the trachea in case of accident. Wolfenden is of the opinion that all operations are merely palliative, and that for that reason it is probably just as well to attack the growth with the galvano-cautery snare.

Even if recurrence does not take place at the site of the operation, the disease is very apt to appear speedily in some other locality, near by or remote. In the course of a discussion of a paper by Cheever, whose name has been associated with one of the external operations, Hayes Agnew¹ stated that there is only one case on record in which recurrence had not taken place, and in that the thermo-cautery was used.

The case reported by Cheever occurred in a man of fifty-seven who had noticed enlargement of the tonsil for one year and had suffered more or less pain for six months. Just before the time when he came under observation, the patient took cold, and his tonsil became swollen and painful and finally discharged spontaneously. The glands of the neck were enlarged, there was dysphagia, and there had been loss of flesh. The tumor was removed by external excision, the jaw being divided in front of the masseter muscle. The facial artery and the external jugular vein were tied. There was no hemorrhage.

The jaw was wired, and the external wound was sutured, but not the internal. On the thirtieth day the wires were removed. Three months later some glands in the neck were extirpated by a second operation. The advantages claimed by Cheever for his operation are that less paralysis and less scarring are caused by it than by one through the cheek. A large proportion of cures have no doubt been reported prematurely. A cure cannot be considered permanent until at least three years have elapsed.

A case reported by Homans² reads as though the removal of a tumor of the tonsil by external incision were the simplest operation possible. His patient was a woman, fifty-nine years old, who for eighteen months had been troubled at intervals with swelling and ulceration of the right tonsil. A microscopic examination showed the growth to be a round-celled sarcoma. The tumor was removed by an incision from the hyoid bone to the mastoid process, the fasciæ were divided, the parotid gland was pushed upward, and the submaxillary gland and the digastric tendon were retracted downward. The constrictor muscle and the mucous membrane of the pharynx were scratched through with a director. The tumor was separated from the pillar and the mucous membrane, by means of scissors, through the mouth. The loosened tonsil was pulled through the wound, and its remaining attachments were severed from within. Only two small vessels required ligation. The external wound healed in five days, and the

¹ Philadelphia Medical Record, May 25, 1889.

² Lancet, London, August 29, 1891.

drainage-tube was then removed. On the fifteenth day the patient was discharged cured.

The period of immunity after operation varies within very wide limits. In the case recorded by Gallardo,¹ a cancerous tumor the size of a hen's egg, involving the tonsil and the soft palate, was removed from a man forty years old. One month after extirpation a tumor appeared in the mastoid region, accompanied by enlargement of the cervical glands. Cachexia developed, and death ensued. In Thorburn's² case of epithelioma, the right tonsil, the soft palate, the alveolar processes of both upper and lower jaws, and the base of the tongue were involved. Pharyngotomy was done, and the mass, together with the enlarged cervical glands, was removed. A month later a recurrent growth was removed from the soft palate. Four months later there had been no recurrence.

As illustrating extremes of age and of malignancy, cases of lymphosarcoma reported by Lediard³ and by Cresswell Baber⁴ are of interest. The former was a soft painless tumor of the right tonsil in a man of sixty-two, who had been under observation for two years. Preliminary tracheotomy was done, the edges of the tumor were snipped, and it was "shelled out" with the finger. Hemorrhage was slight. A gland near the angle of the jaw was left, and subsequently enlarged. Eight months later all glandular swellings were removed by a second operation. Recovery was rapid, and eighteen months afterwards the patient was still exempt from recurrence. It will be observed that the operator did not defer opening the trachea until urgent symptoms arose. In this particular case it proved to be an unnecessary precaution, possibly owing to the fact that but very little cutting was done. One advantage of an external operation is that the cervical glands may be exposed and removed at the same operation with the main tumor. Deeply-seated glandular infiltration may easily escape detection through the unbroken skin. Baber's case was in a girl of fourteen who had a large tumor of the right tonsil and ulceration of the pillar. There were enlarged glands in the axillæ and groin. Several pieces were removed, but rapidly grew again. The rapidity of recurrence is at times astonishing: the growth seems to be stimulated to activity by interference. In a rather extensive operation done by Fowler⁵ an apparently thorough extirpation of morbid tissue proved ineffectual. His patient was a woman of sixty-seven, with a hard, immovable, lobulated growth of the left tonsil the size of a walnut. There was also a glandular mass beneath the posterior border of the sterno-mastoid muscle. The external jugular vein and the stylo-hyoid muscle were divided. The facial and lingual arteries were tied. A curved incision was made through the

¹ *El Bisturi*, June, 1881.

² *British Medical Journal*, April 19, 1890.

³ *Lancet*, London, November 23, 1889.

⁴ *British Medical Journal*, February 7, 1891.

⁵ *Brooklyn Medical Journal*, September, 1888.

hyo-glossus and superior constrictor muscles and the mucous membrane with the thermo-cautery. Thus the tumor was removed practically without hemorrhage. A chain of glands was dissected from the carotid sheath. In ten days the patient could swallow. Eight months later there had been no recurrence in the tonsillar region, but both parotids were involved, and the patient ultimately died of gastric cancer.

There are three recognized methods of reaching the tonsil by external operation. The first is that of Cheever,¹ which according to Cohen is a modification of a plan originally proposed by Blandin. It begins by an incision three or four inches in length from the lobe of the ear along the anterior border of the sterno-mastoid muscle. A second incision is made from the first along the margin of the lower jaw. The tonsil may thus be reached at considerable depth by careful dissection and retraction of the nerves and blood-vessels. Infiltrated glands are removed, and the tonsil itself is rather torn from its bed or detached with a cautery-knife, cutting being avoided as far as possible. In Czerny's operation a preliminary tracheotomy is done, and an incision is made from the angle of the mouth downward to the anterior border of the masseter muscle and from that point to the level of the hyoid bone. The jaw is then exposed and divided between the second and third molar teeth. The fragments being separated, the tumor is exposed, but in order to remove it it may be necessary to divide the digastric, stylo-hyoid, and stylo-glossus muscles, the hypo-glossal, glosso-pharyngeal, and gustatory nerves, the lingual artery, and possibly other vessels. The jaw is reunited by means of silver wire, fortified by a wire twisted around the adjacent teeth. The external wound is sutured, except at the point of drainage, and the wound of the mucous membrane is also sutured. The trachea-tube may be retained, and the feeding-tube is used for several days after the operation. The wire is removed from the teeth in ten days or a fortnight, that through the bone may be left indefinitely. In the operation proposed by Mikulicz² an incision similar in situation to Cheever's, but somewhat longer, is made. The jaw is exposed just above its angle, is divided, and its ascending ramus is resected. The cavities of the mouth and pharynx are not opened: thus the risks attending entrance of blood into the air-passages are much diminished, and the effective use of antiseptic dressings is favored. Although resection of the ascending process of the jaw adds somewhat to the formidable character of the operation, it has the decided advantage of nullifying the ill effect of distorting cicatrization which is so apt to follow an operation involving the palate and base of the tongue.

In a paper published by Donaldson³ a list of seventy-one cases of malignant disease of the tonsil is given. Unfortunately, some of them seem to lack authenticity; but the majority are reliable enough to justify his con-

¹ Boston City Hospital Reports, 1870.

² Deutsche Medicinische Wochenschrift, 1886, vol. xii. p. 157.

³ New York Medical Record, March 7, 1885.

clusion that the treatment at best is palliative, "unless the growth can be removed at its very incipency."

Butlin has collected twenty-three cases, and finds that in three death was a direct result of the operation. In one by Velpeau the patient died of pyæmia on the eighteenth day after an operation through the mouth. Mikulicz lost a patient in two or three hours from collapse and the entrance of blood into the air-passages. Küster lost a case on the eighth day from septic pneumonia. Experience with malignant disease of the tonsil is as yet so meagre as to prohibit final judgment as to the respective merits of the internal and the external method of operating. The former is doubtless safer and easier. In several cases of sarcoma the tumor has been "shelled out" after a slight incision of its capsule. The case with which it may be enucleated furnishes no assurance against its return. Nevertheless it has not yet been demonstrated that an external operation gives any greater encouragement. Of Butlin's twenty-three cases three were alive and apparently well four, twelve, and twenty-four months respectively after the operation.

In the first case an enlarged gland, which persisted unchanged, was left in the neck, the tumor itself having been shelled out from within the mouth. The interval was far too short to authorize calling this a cure.

In the second case (Barker), one of lympho-sarcoma of about three months' duration, in a man more than seventy years of age, the tumor was removed through the mouth, and some enlarged cervical glands were reached by external incision. The patient was well when seen a year or more after operation.

The third case, that of Gorecki,¹ was one of lympho- or round-celled sarcoma of the right tonsil, without glandular enlargements. The tumor was removed with the thermo-cautery knife through the mouth three months after its appearance. Two years later there had been no sign of recurrence.

Pharyngotomy cannot show even so good a record as this, the only case which begins to compare favorably being one operated upon by Mikulicz, in which recurrence was deferred for two years. The patient was a woman of sixty-five, who had a large tumor of the tonsil and involvement of the lymphatic glands of four months' duration. Even if cure is not feasible, a palliative operation through the mouth is indicated, especially in the case of prominent lympho-sarcomata which produce dysphagia and perhaps dyspnea. Although early recurrence is probable, it is rather more likely to take place at some other situation than in the tonsillar region, and thereby the patient is relieved of much distress. In case malignant disease of the tonsil is allowed to run its course without operation, a fatal result may be expected, under the most favorable circumstances, within twelve months. Cheever² himself remarks with reference to his second

¹ *Le Praticien*, 1879.

² *Boston Medical and Surgical Journal*, August 1, 1878.

case that, in view of the rapidity and persistency of recurrence, the wisdom of surgical interference is open to doubt. In my opinion, it is beyond consideration in the majority of cases. By the time most cases reach us the disease is too extensive to admit of eradication. If seen at a very early stage, the best that can be hoped is to prolong life for a few months beyond the period of natural existence were the tumor not interfered with.

It only remains to refer to the exhaustive paper by Poland¹ on "Cancer of the Tonsil Glands," in which the difficulties of diagnosis are especially dwelt upon, to the cases of epithelioma presented to the London Clinical Society in October, 1882, by Bird and Lucas, and to Holger Mygind's² case of primary sarcoma.

The last-mentioned is of unusual interest because of the completeness of the report and of the fact that an attempt was made to dissipate the growth by means of electrolysis. His patient was a man of thirty-one, who had never been ill, with the exception of several attacks of sore throat. The tumor was discovered accidentally by an oculist who noticed the peculiar voice and on looking in the throat saw a mushroom-like mass, as large as a hen's egg, springing from the left tonsil. Up to this time there had been no discomfort. The growth was removed with the galvano-cautery. There was free hemorrhage when the eschar came off at the end of a week, but three weeks later recovery was perfect, and there had been no recurrence in the left tonsil. Seven months later the patient complained of pain in the right side of his throat, and a tumor was discovered growing from the right tonsil. It was removed with scissors and the sharp spoon, the bleeding being controlled by means of chloride of zinc. Two months afterwards indications of recurrence were presented. Pain in the right ear, shortly followed by dysphagia, developed. The patient meanwhile felt perfectly well, and no signs of glandular enlargement could be detected. He would not submit to radical surgical measures, and accordingly it was decided to try electrolysis. In the first seven séances the positive electrode was applied externally; afterwards both electrodes, in the form of gold needles, were applied directly to the growth. The current was used as strong as the patient would bear for twenty minutes at a time for four or five consecutive days, with intervals of three or four days. The extension of the growth was so rapid that the necrotic transformation induced by the current could not keep pace with it, and the patient finally succumbed. The microscopic examination is of great interest as bearing upon Butlin's³ statement that sarcoma of the tonsil is not primary, but is derived from disseminated lympho-sarcomata. The mass taken from the left tonsil resembled a simple hyperplasia, containing more connective tissue than is usual in lympho-sarcoma. The growth from the right tonsil was exactly

¹ British and Foreign Medico-Chirurgical Review, April, 1872, 477.

² Journal of Laryngology and Rhinology, August, 1890.

³ Lancet, London, 1885, vol. ii. p. 760.

similar, while one removed from the right side during the progress of the electrolytic treatment was an undoubted round-celled sarcoma. There seems but little reason to question that all the growths were of the same pathological species, indicating that the lesion of the tonsil was not a local process, but was "an expression of a general disposition to abnormal processes in the lymphatic organs."

From a study of these and similar cases it seems to be fair to assume that when the disease in the fauces is strictly limited to the tonsils and there are no glandular evidences of extensive distribution, we may remove the tumors through the mouth with fair hope of prolonging life. When the indications of generalization are unmistakable, we may resort to a similar method with the expectation of mitigating in a measure the patient's discomfort. The general experience with malignant disease in the tonsillar region is decidedly discouraging as regards radical cure by any method of operating. Recurrence at the site of the lesion or elsewhere is pretty certain within a longer or shorter period. It is very doubtful if any external operations offer a better prospect, while their additional risks and difficulties are by no means undeserving of consideration. Butlin, to whom we are indebted for the results of much careful study of this subject, reaches the following conclusions: "The prospect of permanent relief by operation in any case of malignant disease of the tonsil is very small, even if there can be said to be any. Removal of the disease through an external incision (pharyngotomy) has hitherto proved a dangerous proceeding, and has not yielded as good results as operation through the open mouth. Removal of the disease through the open mouth, in suitable cases, has not hitherto proved very dangerous. No case of cure can be claimed for operation through the open mouth, but several cases of relief of longer or shorter duration. In future cases, pharyngotomy cannot be recommended; and, unless the results procured by it are far better for the next series of cases than those which it has yielded hitherto, it must be condemned as an unjustifiable proceeding." No reasonable exception can be taken to such a presentment of the case.

THE PHARYNX AND LARYNX IN THE EXANTHEMATA AND OTHER FEBRILE AFFECTIONS.

BY RUFUS P. LINCOLN, M.D.,

Member of the New York Academy of Medicine, of the American Laryngological Association, of the American Climatological Society, etc., New York City.

THE affections of the throat in nearly all the acute febrile diseases are of great interest, and in some they assume a position of the greatest possible importance. This is especially the case as regards scarlet fever.

SCARLATINA.

In scarlet fever the sore throat is as essential a feature of the disease as the eruption itself. In fact, so marked is the anginous tendency of this affection that those who enjoy immunity from it, whether adults or children, not infrequently suffer from pharyngitis of greater or less severity when exposed to its contagion. A certain proportion, at least, of these cases are doubtless to be regarded as scarlatina of a rudimentary or abortive character. They occur in persons who have but little predisposition to the disease, and especially in adults who have already had it in childhood. In such patients there is usually some feverishness, though of short duration, with slight swelling of the cervical glands and possibly some enlargement of the tonsils. Attacks of this kind are, as a rule, of but trifling severity, and generally disappear in a few days, but, as Thomas very properly says,¹ they should receive the same attention as is paid to the unmistakable disease. Thus, Fagge² relates an instance in which a father so affected gave to his children a disease of such severity that one of them died.

Most writers on scarlatina state that certain exceptional cases occur in which there is no affection of the throat whatever. Thus, mild cases of this kind are referred to by Flint and Welch,³ Bartholow,⁴ Roberts,⁵ Strümpel,⁶ and Thomas,⁷ and the latter also speaks of "rare cases of scar-

¹ Ziemssen's *Cyclopædia of the Practice of Medicine*, New York, 1875, vol. ii. p. 251.

² *Principles and Practice of Medicine*, London, 1886, vol. i. p. 209.

³ *Principles and Practice of Medicine*, 6th ed., Philadelphia, 1886, p. 1054.

⁴ *Treatise on the Practice of Medicine*, 6th ed., New York, 1886, p. 785.

⁵ *Theory and Practice of Medicine*, 3d Amer. ed., Philadelphia, 1881, p. 166.

⁶ *Text-Book of Medicine*, New York, 1887, p. 44.

⁷ *Op. cit.*, pp. 238, 251.

latina without angina, and yet with rheumatism, kidney-disease, parotitis, and infiltration of the cervical connective tissue in every possible order of succession."¹ Meigs and Pepper,² on the other hand, say that they have never seen a case in which inflammation of the mucous membrane of the fauces was not present to a greater or less extent, and Dr. Billington, who has had an exceptionally large experience with the disease, gives it as his positive conviction that some degree of throat-inflammation is the one symptom that is never absent in scarlatina.³ Cohen⁴ also makes the statement that some amount of sore throat exists in every case. The probabilities are that the latter opinion is substantially correct, and that even in the exceptional cases referred to a careful examination of the pharynx, if made sufficiently early, would reveal an at least evanescent efflorescence on the mucous membrane. All will concur, at all events, with Goodhart⁵ in the statement that the disease in the throat is the most regular in its appearance of all the symptoms of scarlatina.

While all authorities are agreed as to the supreme importance of the lesions of the organs of the throat in this affection, there is some difference of opinion in regard to the exact time at which the angina, as a rule, makes its appearance. Many writers believe this to be synchronous with the febrile invasion, as, for instance, Roberts,⁶ Busey,⁷ and J. Lewis Smith,⁸ but Thomas⁹ says that the throat-trouble follows shortly after the commencement of the fever. Meigs and Pepper¹⁰ place the appearance of the pharyngitis even later. On the other hand, such authorities as Gee,¹¹ Fagge,¹² Goodhart,¹³ Cohen,¹⁴ and Billington¹⁵ regard its occurrence as antedating the fever, and the last-named writer emphatically states, as the result of his own observation, that he has been led to believe that the precedence of angina to every other symptom is probably not occasional or frequent, but invariable. It would seem, on the whole, that there can be little question that were it possible to make a thorough inspection of the fauces in all cases of scarlatina shortly before the occurrence of pyrexia, a certain amount of redness would, as a rule, be sure to present itself, and that even in those instances where, from the intense severity of the infection, the vital powers are at once overwhelmed and death occurs on the

¹ Op. cit., p. 287.

² Practical Treatise on Diseases of Children. Philadelphia, 1886, p. 770.

³ Medical Record, New York, March 23, 1878.

⁴ Diseases of the Throat and Nasal Passages, New York, 1879, p. 111.

⁵ Guide to the Diseases of Children, Philadelphia, 1885, p. 176.

⁶ Op. cit., p. 163.

⁷ Keating's Cyclopædia of Diseases of Children, Philadelphia, 1889, vol. i. p. 566.

⁸ Pepper's System of Practical Medicine, Philadelphia, 1885, vol. i. p. 504.

⁹ Op. cit., p. 237.

¹⁰ Op. cit., p. 777.

¹¹ Reynolds's System of Medicine, Philadelphia, 1870, vol. i. p. 151.

¹² Op. cit., p. 207.

¹³ Op. cit., p. 173.

¹⁴ Op. cit., p. 111.

¹⁵ Op. cit.

very first day, this early local sign of the scarlatinous poison would not be lacking.

In scarlatina the throat-lesions are of all degrees of severity, varying from those of the mildest possible grade to those of the most intense and destructive character. The pharyngeal manifestations, although presenting infinite variety, have been succinctly classified by Osler¹ in three groups. There may be—

First. Slight redness, with swelling of the follicles of the tonsils.

Second. A more intense grade of swelling and infiltration of the parts, with a follicular tonsillitis.

Third. Membranous angina, with intense inflammation of all the pharyngeal structures and swelling of the glands below the jaw, and in very severe cases a thick, brawny induration of all the tissues of the neck.

These different forms of pharyngeal trouble, it must, however, be remembered, are simply different grades of one and the same process.² Thomas, with other authors, holds that the pharyngitis of scarlatina, when of a typical nature, is confined to certain sections of the throat, and in proof of its specific character he quotes Hürlin's demonstrations upon the cadaver.³ As a characteristic sign the latter describes a deep bluish-red injection of the mucous membrane of the tonsils and neighborhood of the highly-swollen papillæ, of the posterior portion of the region of the cricoid cartilage, and of that portion of the pharynx which includes these different parts. He maintains, furthermore, that the peculiarity of this coloring lies in the circumstance that in the direction of its transverse diameter it is very sharply outlined, and, finally, that wherever the parts are inflamed the mucous membrane will be slightly swollen and the submucous connective tissue infiltrated with serum. Klein found peculiar changes also in the lymphatic follicles of the tonsils, pharynx, and larynx. In the central portion of these follicles the ordinary unilocular lymph-cells forming their chief bulk were greatly decreased in number, their place being taken by large granular cells containing from two to twenty or more germinating nuclei.⁴ As regards the larynx in ordinary cases of scarlatina, it seems probable that there is often present some hyperæmia or even slight catarrhal inflammation of its lining mucous membrane, as indicated by the results of Klein's investigations just noted, but that the laryngeal affection is, as a rule, of a very mild character is shown by the lack of hoarseness in the voice and the absence of cough. In the graver cases with more aggravated throat-trouble, however, the condition of the larynx sometimes constitutes one of the principal dangers to which the patient is exposed.

In severe cases there is often marked œdema of the uvula, and under these circumstances it becomes club-shaped, and, with the enlarged tonsils

¹ Principles and Practice of Medicine, New York, 1892, p. 69.

² Ziemssen's Cyclopædia, vol. ii. p. 215.

³ Ibid., vol. ii. p. 216.

⁴ Roberts, Theory and Practice of Medicine, Philadelphia, 1881, p. 162.

projecting inward, may entirely block up the passage.¹ Not only are follicular abscesses observed in the tonsils and upon different parts of the inflamed mucous membrane, but parenchymatous tonsillitis may quickly result in the formation of large abscesses and in destructive ulceration or sloughing. The phlegmonous inflammation may also be propagated to the connective tissue in the submaxillary region and give rise to extensive purulent collections there.

Even in comparatively mild cases the inflammatory process sometimes extends from the pharynx into the Eustachian tube and thence to the mucous membrane lining the cavity of the middle ear. In bad cases this is very common, and it is often attended with the most serious consequences. The various affections of the ear which scarlatinous pharyngitis is apt to leave behind it are so numerous and severe that Fagge states that it may be regarded as almost always responsible for the occurrence of deafness acquired in early life.²

The author's experience leads him to question the correctness of Fagge's conclusion as to the part chiefly responsible for the aural complications.

The more general use of the laryngoscope will convince the observer that it is especially when the adenoid tissue of the vault of the pharynx, sometimes called the third tonsil, is hypertrophied that it is apt to be affected in scarlatina in the same way as the faucial tonsils, and is largely responsible for aural inflammations. The possibility of this accident emphasizes one of the advantages of an early operation for the removal of this tissue, an operation free from danger, and, when indicated, followed by the happiest results.

Ulceration of any part of the throat other than the tonsils before the fifth day of the disease is very uncommon, except in the worst cases, but during this period the excess of the secretion of the part smeared over the surface is very liable to be mistaken for sloughing.³ In cases of very severe pharyngitis, however, early ulceration may occur. From the first the mucous membrane is of a livid or purplish hue, its consistence is softened, and it is much swollen, and covered with a layer of grayish or sanious pus. The faucial turgescence and the accumulation at the entrance of the larynx of the accompanying secretion of viscid mucus or muco-pus often cause noisy respiration, and the patient continually breathes with the mouth wide open.⁴ While in comparatively mild cases the submaxillary and cervical glands are enlarged, and the cervical connective tissue sometimes swollen, in the most severe cases there is an intense inflammation of the lymphatics, and the neck is surrounded by a single broad, indurated swelling, sometimes known as the "collar of brawn." In addition, the retro-pharyngeal tissue becomes swollen, and retro-pharyngeal abscess

¹ Fagge, *op. cit.*, p. 207.

² *Op. cit.*, p. 211.

³ Gee, *Reynolds's System of Medicine*, vol. i. p. 153.

⁴ J. Lewis Smith, *op. cit.*, p. 508.

sometimes results. As J. Lewis Smith says,¹ however, when there is an extensive infiltration and swelling of the tissues of the neck, with an amount of ulceration which in itself involves danger, continuing after the primary scarlatina abates, producing fever and reducing the strength, it is proper to regard the state of the throat as a complication rather than an essential part of the disease.

Pseudo-membrane is very commonly met with in the pharynx in the graver cases of scarlatinous angina, sometimes appearing on the second or third day, but often not until the fifth or sixth day, or even later.² While the exudation occasionally takes place in the larynx also, it must not be overlooked that the larynx may be the seat of the most serious trouble not dependent upon the presence of pseudo-membrane. Thus, there may be catarrhal laryngitis of a pronounced character, though this is less common than in measles, or the ulcerations of the pharynx may extend into the larynx.³ Mackenzie states⁴ that it has been observed that in diseases of the larynx dependent on, or associated with, scarlatina, there is a great tendency to the ulcerative process. Gangrene spreading from the mucous surfaces above may also involve the larynx.⁵ Then, again, œdema of the epiglottis and ary-epiglottic folds may occur in connection with the œdema of the uvula and soft palate. The œdema which sometimes occurs after the active symptoms of scarlatina are past may be dependent on the debility which exists during the convalescence of severe febrile complaints, or may be due to the renal affection which so often follows this disease.⁶

But to return to the pseudo-membranous exudation. Is the formation of false membranes due to the complication of scarlatina with the disease diphtheria, or is scarlatina itself capable of producing these membranes? This question and the relation of true diphtheria to scarlatina have of late years excited an immense amount of discussion in the profession. From our present knowledge it can be asserted with considerable confidence that the diphtheritic exudation met with in scarlatina (whether it is possible or not to distinguish anatomically between pseudo-membrane due to the specific diphtheritic poison and that which is not) is in certain instances caused by the scarlatinal disease alone and in others by true diphtheria. The case is well stated by Bussey,⁷ who says there is no longer any doubt that scarlet fever may be associated with the formation of a membrane in the throat and upper air-passages similar to diphtheritic exudation. In some cases the membrane is diphtheritic, in others it is a scarlatinal affection. "In the latter class of cases," he goes on to say, "it appears between the third

¹ *Op. cit.*, p. 509.

² Rilliet and Barthez, Meigs and Pepper on Diseases of Children, p. 788.

³ Meigs and Pepper, *op. cit.*, p. 788.

⁴ Reynolds's System of Medicine, vol. iii. p. 456.

⁵ Roberts, *op. cit.*, p. 165.

⁶ Mackenzie, *op. cit.*

⁷ *Op. cit.*, p. 564.

and sixth days, and rarely invades the larynx, but may extend into the posterior nares. The cervical glands may enlarge and suppurate, but this form is never followed by paralysis. . . . True diphtheria does not usually appear before the second week, and is a much more serious complication. . . . It may complicate the mildest as well as the severe forms of scarlatina, and may assume the form and extent of an ordinary case of diphtheria or one of the most malignant type. In all cases the course of the fever is exaggerated by this complication. It is probably due to a secondary infection with the germ of true diphtheria."

As Porter, of St. Louis, stated in a discussion on croup and diphtheria in the Section on Laryngology and Otology of the American Medical Association in 1890, it cannot be denied that in certain instances a plastic exudation is found in the larynx which is no more diphtheritic (in the sense of being caused by the poison of the disease diphtheria) than is plastic bronchitis, or the partially organized exudation which may follow acute inflammation of the mucous membrane anywhere.¹ Arguing in the same way, J. Lewis Smith states that he can see no reason why the scarlatinal inflammation, when active, may not be membranous, and that those no doubt err who ignore this and consider every inflammation attended by a follicular exudation diphtheritic.² Dr. Smith believes, however, that when scarlatina occurs in localities where diphtheria is prevalent, true diphtheria is very liable to supervene.³

Tcherniaeff⁴ claims to have demonstrated certain microscopical differences not only in the membranes, but also in the tissues of the throat, between scarlatinal and genuine diphtheria; but, whether these differences can be substantiated or not, there is one test which can now be applied in doubtful cases,—viz., the bacteriological test.

Recent investigations have demonstrated to the satisfaction of the great mass of scientific authorities that the Klebs-Loeffler bacillus is the specific microbe of diphtheria. Therefore, in a case of pseudo-membranous angina, if this bacillus is found, there can be little question that true diphtheria has supervened, while, on the other hand, if it is absent, the case may probably be regarded as one of purely scarlatinous diphtheria. In the latter affection, while the Klebs-Loeffler bacillus is lacking, it is said that there are invariably found in great numbers septic streptococci, which penetrate deeply into the mucous and submucous tissues and are accompanied by deeply-seated foci of necrotic disintegration.⁵ Among the most inter-

¹ Journal of Laryngology and Otology, August, 1890, p. 325.

² Pepper's System of Practical Medicine, vol. i. p. 516.

³ Op. cit., p. 514.

⁴ Transactions of the Third General Meeting of Russian Medical Practitioners at St. Petersburg, 1889, No. 6, p. 175; Journal of Laryngology and Rhinology, June, 1889, p. 242.

⁵ Prof. Vysokovitch, of Cracow, Journal of Laryngology and Otology, June, 1889, p. 243.

esting researches on this subject are those of Hutinal, who in scarlatinous angina found that the secretions from the faucial surface and the faucial surface itself contain numerous microbes, of which the streptococcus is by far the most abundant and is apparently an active agent in producing the inflammation. This streptococcus, he says, seems to be identical with that which occurs in suppurative processes, known as the Rosenbach pyogenic streptococcus.¹ Wurtz and Bourges have also established the presence of a streptococcus existing alone or coexisting with the streptococcus albus, which they declare to be very similar to, though not identical with, that of erysipelas.² It may be stated, further, that Chantemesse claims to have shown that these streptococci form pseudo-membranes with even greater facility than the Klebs-Loeffler bacillus.³ Both these forms of diphtheritis which occur in the course of scarlatina are capable of producing stenosis of the larynx and œdema of the glottis and aryteno-epiglottic folds, though, fortunately, these complications are comparatively rare.

True diphtheria, according to Thomas,⁴ may complicate scarlatina even in the stage of incubation, so that the symptoms of scarlatina and diphtheria appear simultaneously, or the diphtheritic symptoms may precede those of scarlatina. As regards the larynx, he holds that diphtheria and croup of this organ may not only occur during the course of an extensive pharyngeal diphtheria, but may even precede it, in some cases manifesting itself as early as during the prodromal stage of scarlet fever.⁵

J. Lewis Smith states⁶ that a thin film or flake of fibrinous exudation, rendering the respiration noisy, developed on the laryngeal or tracheal surface, is, he thinks, not infrequent in diphtheria complicating scarlet fever, but the rapid development of a thick and firm pseudo-membrane, so as to imperil the life of the patient from stenosis in the air-passages, has been much less frequent in his practice than it is in primary diphtheria and in diphtheria complicating measles or pertussis. In regard to the subject of mortality, Ingals states⁷ that in the anginous variety of scarlatina, where there is much swelling, about one-quarter of the patients die; of the diphtheritic variety, about one-half.

One of the most formidable conditions met with in the anginas of scarlatina is gangrene. In some epidemics it is of comparatively frequent occurrence, and in others is extremely rare, but it is liable to be met with at any time in grave cases, whether pseudo-membranous exudation is present or not. Sometimes, as J. Lewis Smith points out,⁸ it is very difficult to

¹ *Revue Mensuelle des Maladies de l'Enfance*, July, 1886.

² *Journal of Laryngology and Otology*, September, 1890, p. 377.

³ *Annales des Maladies de l'Oreille et du Larynx*, February, 1891, p. 137.

⁴ *Op. cit.*, p. 218.

⁵ *Op. cit.*, p. 222.

⁶ *Op. cit.*, p. 517.

⁷ *Keating's Cyclopædia of Diseases of Children*, vol. ii. p. 425.

⁸ *Op. cit.*, p. 516.

distinguish in the swollen fauces between a membranous exudation and superficial gangrene, as the grayish-white surface, jagged and foul, may be the one or the other, an exudation or a sphacelus. Meigs and Pepper also state¹ that the pseudo-membrane is liable to become so changed as to assume the appearance of gangrenous sloughs, and they believe that the majority of the cases which have been regarded as instances of gangrene of the throat are really of this character. When gangrene does occur there is almost invariably associated with it severe inflammation of the submaxillary lymphatic glands and the surrounding cellular tissue. Under these circumstances, if the condition supervene early in the attack, Thomas shows that the connective tissue at the entrance of the larynx is liable to become infiltrated and the mucous membrane of this region to become ulcerated and the seat of a purulent catarrh, which may lead to œdema of the glottis.² Perhaps the most frequent seat of gangrene is the tonsils. The gangrenous process may go on until the whole tonsil is destroyed and it comes away in a single piece, and it may also spread in every direction, destroying the palatine arches, the uvula, and even the whole of the soft palate, as well as extending to the connective tissue of the neck and producing the most disastrous results. As the sloughs are thrown off, leaving a horribly offensive cavity, the cartilage and bone in the vicinity may be laid bare. When this is the case, dangerous or fatal hemorrhages frequently occur from the smaller vessels, and even the carotid artery or internal jugular vein may be opened. As regards the prognosis when gangrene occurs, J. Lewis Smith states that this depends largely on the size of the slough,³ and Thomas believes that recovery can take place only when the gangrenous portions are small, as where the destruction has been confined to the tonsils.⁴

In the London *Lancet* of June 6, 1891, H. Noble Joynt describes three varieties of malignant scarlatina, which he defines as an acute form characterized by profound disturbance of the central nervous system by the poisonous effects of the scarlatinal virus, unaccompanied by marked inflammatory lesions, and usually proving fatal within a week. The throat-affection in these different forms is given as follows. In the first, or asthenic, in which the rash is badly marked or wholly wanting, the fauces are somewhat swollen, foul, dryish, and of a dark, purplish-red color, while the tonsils are slightly enlarged. Unless kept continually syringed, all the structures of the mouth become coated with a foul, viscid mucus, which clings to the palate and tongue. If the pharyngeal inflammation becomes more intense, the tonsils enlarge and superficially ulcerate, and a fetid, purulent discharge oozes from the nostrils. The ulceration is always slight and secondary, the faucial swelling and dark congestion being the conspicuous features. In the second, or anginal form, in which also the rash is scanty, the tonsils are more swollen. Ulceration is always present, and may spread to the

¹ Op. cit., p. 788.

² Op. cit., p. 217.

³ Op. cit., p. 222.

⁴ Op. cit., p. 572.

pharynx and nasal passages, and a diphtheritic membrane often coats the tonsils. In the third, or congestive variety, in which the rash is well developed and very dark, the tonsils are seldom enlarged, but the mucous membrane has the peculiar dark red-brown hue which has been likened by Dr. W. H. Line to "the appearance and glazed lustre of well-polished Spanish mahogany." Ulceration is uncommon, and when present is superficial.

In the scarlatina which occurs in puerperal women the angina is stated by many to be extremely slight or altogether lacking,¹ but Ramsbotham says in regard to it, "the throat is always more or less affected; the tonsils and uvula display a deep scarlet color, and are much swollen; sometimes a slough forms on one or both tonsils."²

Treatment.—If the conclusions afforded by the recent bacterial researches in regard to scarlatinal angina be regarded as correct, it is evident that the older methods of treatment must be materially modified. The best authorities certainly now accept them, and, whether the bacteriologists are right or not, the fact remains that in practice the frequent antiseptic treatment of the pharynx of late years adopted has been attended with a gratifying improvement in results. No one in the profession is better entitled by his position and experience to be heard on this subject than Dr. J. Lewis Smith. In Hare's *Therapeutics*, just issued, he says,³ "All physicians know that scarlet fever, more than any other disease, is liable to be complicated and followed by inflammations which greatly increase its gravity and mortality, and the theory that the microbes which cause these inflammations originate to a great extent upon the inflamed faucial and nasal surfaces receives support from recent investigations. . . . Early and frequent disinfection is a means, therefore, of the highest importance in diminishing the nasal, post-nasal, and faucial inflammation, and in diminishing or preventing inflammation of the Eustachian tube and middle ear, as well as of the lymphatic glands and the connective tissue of the neck. The best means of treatment appear to be spraying or injection every half-hour or hour with the peroxide of hydrogen, one part to four of water for the fauces, one to eight for the nares, or with some other non-irritating but efficient disinfectant." In a paper read before the New York County Medical Association, March 21, 1892, Dr. Smith recommends rather stronger solutions of the peroxide,—namely, one to two or three for the fauces, and one to six for the nares.

Even when the pharyngitis is of a very mild grade, then, it is requisite that this plan of treatment should be adopted, with a view to preventing a possible increase or extension of the inflammatory process. Other antiseptic agents that may be used with advantage in the same way are chlorine, boric

¹ Strümpel, *op. cit.*, p. 36; Playfair, *Science and Practice of Midwifery*, Philadelphia, 1880, p. 596; Lusk, *Science and Art of Midwifery*, New York, 1885, p. 261.

² *Principles and Practice of Obstetric Medicine and Surgery*, Philadelphia, 1855, p. 551.

³ Hare's *System of Practical Therapeutics*, Philadelphia, 1892, vol. ii. p. 192.

acid, benzoic acid, permanganate of potassium, carbolic acid, corrosive sublimate, tincture of chloride of iron, pyocetanin,¹ and salicylic acid. Flint and Welch specially mention solution of chlorinated soda diluted with eight or ten parts of water, and permanganate of potassium in the strength of half a grain to five ounces of water.

In the London *Lancet* of June 13, 1891, Dr. T. F. Craiger gives an analysis of ten hundred and eight cases of scarlatina treated at the Southwestern Hospital during the year 1890, and states that in the sore throat and glandular implication frequent syringing out the fauces and nares with a solution of chlorine or boric acid was most useful, clearing away offensive secretions and lessening discomfort. Ulcerative stomatitis was observed in twenty-seven cases, and three of these took on the characters of "noma," requiring treatment with fuming nitric acid. In no instance did diphtheria, faucial or laryngeal, make its appearance; and the writer expresses the opinion that with good hygienic conditions and avoidance of contagion from cases of diphtheria it should not occur.

In the London *Lancet* of April 25, 1891, N. S. Manning states that during the previous two years he had treated the ulcerated throat of scarlatina and diphtheria in over five hundred cases at the Birmingham City Hospital (the relative proportion of cases of the two diseases is not given) with irrigations of hot water containing a solution of boric acid prepared in the following way: four parts of powdered boric acid are gradually stirred in with three parts of glycerin heated by steam until the solution is perfect. Of this a large tablespoonful is dissolved in a pint of water at a temperature of about 105° F., and it is employed by means of a syringe every two to four hours. His experience with this method of treatment has been so favorable that he recommends it as superior to any other that he has ever tried. "I believe its efficacy," he says, "is founded on the rational principle of washing away all septic discharges with a non-irritating, non-poisonous fluid."

J. Lewis Smith recommends the following for spraying:

R Acidi carbolic, ℥ss, vel acidi borici, ℥ii;
Potass. chlorat., ℥ii;
Glycerini, f℥ii;
Aquæ, f℥vi.—M.

Chlorate of potassium has long been regarded as an important remedy in scarlatinal pharyngitis, and there is reason to believe that it does possess a certain amount of efficacy. It is frequently employed as an ingredient of gargles, in those able to use this form of application, and in young children it is commonly given by the mouth, as it is considered to have a favorable local action on the inflamed surfaces which it passes over during deglutition. It should be used with caution, however, as it has been repeatedly shown within the last few years that its too free exhibition may

¹ Lincoln, New York Medical Journal, October 31, 1891.

be attended with serious and even poisonous effects. Jacobi states¹ that an infant of one year should not be given more than fifteen grains, and a child of from three to five years not more than twenty to thirty grains, in the twenty-four hours, while an adult should not take more than a drachm and a half during this period. It is important also, he says, that this amount should not be given in a few large doses, but in small doses repeated at short intervals. A favorite way of administering this salt is to give it in connection with tincture of chloride of iron and glycerin.

The following formula² which Dr. Smith is in the habit of using in diphtheria will sometimes prove of value in cases of scarlatina. It is to be employed with a throat atomizer for from three to five minutes at a time.

R Olei eucalypti, fʒii;
Sodii benzoat., ʒi;
Glycerini, fʒii;
Aq. calcis, Oi.—M.

If the surface of the throat be covered with foul secretions, he at times employs a solution of carbolic acid and chlorate of potassium in glycerin and lime-water, or else the following:³

R Tinct. ferri chlor., fʒss;
Acidi sulphurosi, fʒii;
Glycerini, fʒi;
Aq. calcis, q. s. ad fʒvi.—M.

As an accessory to the local treatment, fumigations in the sick-chamber are often of great service, and Dr. Smith recommends for this purpose the following mixture, which he constantly uses in his practice:

R Olei eucalypti,
Acidi carbolici, aa fʒi;
Spt. terebinth., fʒviii.—M.

Of this, two tablespoonfuls are added to a pint of water and allowed to simmer day and night at the bedside; or cloths saturated with the mixture may be laid on the bed and hung about the room.

If, in spite of the irrigations practised, the more serious throat-complications which have been described ensue, or if these have already occurred when the case is first seen, more active measures are sometimes called for; though it may be mentioned, in passing, that the detergent and astringent gargles which are of service in ordinary pharyngitis and tonsillitis have their place in the treatment of scarlatinal angina when the patient is old enough to make use of them. Local applications may be made with a camel's-hair brush, or otherwise. A favorite one with Goodhart⁴ is boric acid and

¹ Archives of Pediatrics, January, 1889.

² Keating's Cyclopædia of Diseases of Children, vol. i. p. 671.

³ Pepper's System of Practical Medicine, vol. i. p. 546.

⁴ Op. cit., p. 197.

glycerin, or that in combination with bicarbonate of sodium, and with Meigs and Pepper,¹ ten grains of glacial carbolic acid with a drachm of solution of subsulphate of iron in an ounce of glycerin. The latter combination is recommended, too, by J. Lewis Smith,² who uses two drachms of the subsulphate solution instead of one; also the following: one drachm each of oil of eucalyptus and carbolic acid to eight ounces of olive oil. If sloughing and gangrene are taking place it may be necessary to employ nitrate of silver in strong solutions or in substance, or the mineral acids; and if there is much fetor, Bartholow advises³ dilute sulphurous acid, iodine, and carbolic acid together in solution. In the mean while the disinfectant irrigations should also be regularly maintained as before.

Abscesses of the tonsils may sometimes be lanced with beneficial effect, and if œdema of the glottis should occur, scarifications should be tried before proceeding to more radical measures. In case perforation of the internal carotid artery should occur from sloughing of the tonsil, ligation of the common carotid might possibly be tried, in accordance with the suggestion of Vergely for the arrest of hemorrhage when a similar accident occurs in phlegmonous tonsillitis.⁴ If pseudo-membranous exudation forms, whether this is due to the true diphtheritic poison or not, the treatment should be practically the same as in primary diphtheria. In all cases where the throat-lesions are at all severe, external applications upon the neck are called for. In many cases, and especially in the early stages, these should be of a cooling character, such as cloths frequently wrung out of cold water, or the elongated rubber bag. In others, warm applications, such as poultices, frequently changed, and spongiopilin wrung out of hot water, will prove of more service. Throughout the disease the free use of iced drinks and the sucking of pieces of ice are likely to afford relief, and may be of benefit in combating the pharyngeal inflammation.

VARIOLA.

Next after scarlet fever, of the exanthematous diseases, as regards the frequency and importance of the throat-lesions, must be ranked small-pox. Indeed, serious involvement of the larynx is very much more generally met with in the latter than in the former. Thus, Rühle, who in 1856 and 1857 made fifty-four autopsies during a severe epidemic of small-pox at Greifswald, states⁵ that out of the whole number there was not a single case in which the larynx and trachea were in a normal condition, and that, consequently, he could not but attribute a certain proportion of the mortality to the laryngeal affection.

The throat-trouble not infrequently commences during the stage of

¹ Op. cit., p. 825.

² Op. cit., p. 546.

³ Op. cit., p. 788.

⁴ Gazette Médicale de Strasbourg, June 1, 1888.

⁵ Kehlkopfkrankheiten, Berlin, 1861, p. 247.

invasion, or even in that of incubation. In some cases there is at this time simply a somewhat dusky hyperæmia of the mucous membrane of the pharynx and tonsils; in others the condition amounts to a catarrhal inflammation, with redness and swelling of the soft palate, uvula, and tonsils, and in rare instances this extends to the larynx, as indicated by the hoarseness present. As this inflammatory process is apt to be associated with epistaxis and coryza with its attendant symptoms, including lachrymation and intolerance of light, there is some danger of the disease being mistaken for measles when it occurs. In the frightful purpura variolosa (regarded as the initial stage of hemorrhagic small-pox), in which death frequently occurs before the small-pox eruption can develop, ecchymoses and membranous exudations take place in the pharynx, and a horrible fetor is emitted from the foul surfaces.¹

Occasionally in the stage of invasion the congested faucial mucous membrane is studded with small elevated spots, which are the precursors of the future eruptive lesions. As a rule, however, the eruption does not make its appearance in the throat until immediately before or coincidently with its development upon the skin. In a few mild cases, indeed, the eruption does not invade the mucous surfaces at all, and in these exceptional instances there is generally a simple inflammation of the pharynx. In ordinary cases the pocks appear upon the soft palate and tonsils as well as the other pharyngeal structures, and often in the larynx and trachea.

The eruption on the mucous membrane is analogous to that on the skin, but not identical with it, since there is no *stratum corneum*, and the heat, moisture, and friction to which the surfaces are exposed serve to modify its character. It is stated, however, that typical, fully-distended pustules may form and occasionally persist upon the soft palate.² Usually the pocks appear first as small elevated spots, which soon assume an opaque and, according to some authors, umbilicated appearance, contrasting strongly in color with the general surface, redness of which is the preliminary sign of the eruption. Within a short time these lose the epithelium covering them and are changed into little excoriations or ulcers, which eventually heal without cicatrices. If the eruption is well marked it is apt to result in a secondary inflammation of the mucous membrane of the pharynx, which may be phlegmonous in character and give rise to abscess of the tonsils or other parts, as well as more or less purulent infiltration of the submucous connective tissues and enlargement and tenderness of the submaxillary glands. Welch states³ that the eruption on the mucous membrane, differing from that on the skin, assumes a pseudo-membranous appearance, and that the fauces often look as if they were covered with true diphtheritic membrane. A tenacious secretion which clogs and clings to the parts often

¹ Curschmann, Ziemssen's Cyclopædia, vol. ii. p. 354; Bartholow, op. cit., p. 759; Strümpel, op. cit., p. 54.

² J. N. Hyde, Pepper's System of Medicine, vol. i. p. 439.

³ Hare's System of Therapeutics, vol. ii. p. 260.

adds to the distress caused by the rawness and soreness of the pharynx, and in many cases there is profuse salivation, the secretion becoming more viscid and offensive as the disease progresses. As one would naturally suppose, the pharyngeal inflammation sometimes involves the Eustachian tube, the lower end of which is frequently swollen and infiltrated with pus, and in occasional instances the inflammatory process extends along the tube to the middle ear.

If associated with slight or no secondary inflammation, the presence of the variolous eruption in the throat may give rise to but little inconvenience,¹ but severe laryngitis is a very common occurrence in this disease. From his experience Rühle² has been led to consider croupous or diphtheritic inflammation as the essential peculiarity of the laryngeal affection in small-pox. When the larynx becomes implicated it is denoted by hoarseness or aphonia, and in severe cases by more or less difficulty of respiration, which, as Cohen shows,³ may be due to œdema of the ary-epiglottic folds or other structures. In one case reported by him, in which aphonia occurred suddenly without having been preceded by hoarseness, there was found paralysis of the arytenoid muscle. Ulcerations of the larynx are sometimes so severe as to cause death, and Cohen⁴ refers to an instance related by Bernutz⁵ in which there was even perforation of that organ. Spasm of the glottis is occasionally met with, and acute œdema of the latter is an accident that may occur at any time in severe cases. Another possible cause of asphyxia mentioned by Cohen is the mechanical obstruction to respiration resulting from the exfoliation of the laryngeal mucous membrane. Sometimes the lesions in the larynx result in perichondritis, with secondary necrosis of the cartilage.

In confluent small-pox the ulcerations are larger and the pharyngitis and laryngitis naturally more intense than in the discrete form, though the mucous membranes in exceptional cases escape with little or no involvement. Thus, in one case examined by Mackenzie⁶ at the London Small-Pox Hospital the larynx appeared perfectly healthy, and in another there was simply congestion of the mucous membrane. In children especially is the throat-trouble apt to be fatal. As Meigs and Pepper state,⁷ the supply of air becomes so diminished by the various causes of obstruction (swelling, collections of viscid phlegm, and spasm of the glottis) that the blood does not receive its due amount of oxygen, a venous stasis is established, and the patient dies, sometimes in great distress, though in other instances with very little apparent suffering, in a state of asphyxia. In adults, as well as children,

¹ Mackenzie, *op. cit.*, p. 455.

² *Op. cit.*

³ *Op. cit.*, p. 107. He refers to cases mentioned by Gibb and Bernutz in which death occurred from subglottic œdema.

⁴ *Op. cit.*, p. 107.

⁵ *Lyon Médical*, November 10, 1872; *Lancet*, November 23, 1872, p. 750.

⁶ *Op. cit.*, p. 455.

⁷ *Op. cit.*, p. 737.

pseudo-membranes often form on the fauces, which may extend to the posterior nares, pharynx, and larynx, causing great pain and dysphagia, fetid breath, and sometimes all the symptoms of diphtheritic croup. "Pasty accumulations of muco-pus and diphtheritic exudation, like macerated chamois leather, line the mouth, pharynx, larynx, and even the bronchi. Beneath these masses the eroded mucous surface is dry, livid red in color, and has a varnished aspect. Gangrene here may lead to necrosis of the cartilages of the larynx. Aphonia is often complete, deglutition impossible, respiration difficult."¹

When the pocks are numerous in the larynx they produce a peculiar hoarse, metallic sound in coughing, indicative of their presence in this location, and, whether pseudo-membranous exudation exists or not, sudden asphyxia may occur from rapidly-developed œdema of the glottis, or other cause. These sudden fits of suffocation often prove fatal in a few seconds, before anything can be done to relieve them, and Trousseau mentions three cases of this kind, in each of which death seems to have occurred quite unexpectedly on the eighth day of an illness which had previously run a perfectly normal course.² If the patient survive, the injuries sustained by the larynx may prove permanent; and Cohen³ states that in some cases examined by him years after an attack of confluent small-pox the larynx appeared in a state of chronic inflammation, with little ulcerations upon the surface of the vocal cords, which were much congested. He also cites four cases related by Gibb, in one of which one vocal cord appeared to have been destroyed by small-pox, while in another the patient had been the subject of aphonia, hoarseness, and chronic laryngeal disease for thirty-eight years subsequent to an attack of this disease.

In the hemorrhagic variety of small-pox livid spots appear in the mouth and throat, and, according to Kaposi, the mucous surfaces become dry, crack, and bleed where the epithelium is torn, and eventually are covered with offensive crusts.⁴ Diphtheritic exudations also often spread over the palate, tonsils, and pharynx, and add to the extreme fetor of the patient's breath. The larynx is also sometimes affected by the purpuric condition, though less frequently than the pharynx, and in a case of this kind Mackenzie⁵ found ecchymotic spots on the under surface of the epiglottis and on the mucous membrane over the arytenoid cartilages.

Among the complications and sequelæ of the affections of the throat in small-pox may be mentioned suppurative inflammation of the parotid and other salivary and cervical glands, purulent otitis media, and laryngo-cæso-phageal abscess. True diphtheria may sometimes supervene, but in small-pox, as in scarlatina and other febrile diseases, pseudo-membranous

¹ J. N. Hyde, *op. cit.*, p. 441.

² Fagge, *op. cit.*, p. 238.

³ *Op. cit.*, p. 108.

⁴ Hyde, *op. cit.*, p. 442.

⁵ *Op. cit.*, p. 455.

exudations not infrequently occur entirely independent of the agency of the specific diphtheritic virus. It is also a fact that confluent pustules with irregular ulceration upon the soft palate and pharyngeal mucous membrane are extremely liable to be mistaken for diphtheritic processes. Œdema of the glottis and of other parts of the larynx has already been referred to as an important complication in the active course of the disease. Such œdema, however, occasionally makes its appearance after the eruption has disappeared, and a case of this kind, which occurred at the New York City Small-Pox Hospital on Blackwell's Island, is reported in the *New York Medical Journal* for September, 1874. Laryngotomy was performed, but the patient died eighteen hours after the operation.

Treatment.—Much of what has been said in reference to the treatment of scarlatinous angina will probably apply with equal force to that of variolous. The fetor of breath which is so constantly remarked in small-pox would of itself suggest, aside from other considerations, the propriety of the early and persistent use of disinfectant gargles, sprays, or injections. On account of the excessive soreness and painfulness of the pharynx and larynx present in many cases, especially in the confluent variety of the disease, a spray of cocaine solution might, no doubt, be used with advantage, and it would prove further serviceable also in relieving the congestion of the mucous membrane. The sucking of pieces of ice and the frequent use of bland articles, such as flaxseed or marshmallow tea, mucilage of gum arabic or slippery elm, and jellies of various kinds, will often be grateful to the patient and afford considerable relief. When the pain and swelling in and about the throat are intense, the ice or cold-water bag may be applied externally, though in some instances hot fomentations or poultices will prove more beneficial. In young children Blackader recommends¹ that several times a day the nurse should cleanse the mouth and fauces with a small swab of absorbent cotton soaked in borax solution, and some such procedure as this should also be adopted in the case of adults who are feeble or delirious. In case œdema of the glottis or ary-epiglottic folds should occur, an emetic may first be tried, if the patient's strength will permit, and if this fails to afford relief, or in place of the emetic, scarification of the parts should be practised. Should the latter prove unavailing, intubation or tracheotomy will have to be resorted to. When pseudo-membranous exudation is present, the treatment should be the same as in primary diphtheria.

VARIOLOID.

In varioloid poeks may appear upon the mucous membrane of both the pharynx and the larynx, but they are usually scanty and seldom give rise to serious ulcerative or pseudo-membranous processes. In connection with them, however, there is in a few cases a considerable amount of inflammation, with difficulty of deglutition, and hoarseness.

¹ Keating's *Cyclopedia of Diseases of Children*, vol. i. p. 739.

VARICELLA.

In a considerable proportion of the cases of chicken-pox the eruption is present upon the mucous membrane of the throat, and it is rarely lacking there if the crop of vesicles is at all abundant upon the skin. The pocks are often very numerous on both the hard and the soft palate, but, as a rule, much less so on the parts beyond. When they first appear they are described by Thomas¹ as flaccid vesicles upon a somewhat hyperæmic ground; but they soon lose their epithelial covering and are recognizable only as excoriations. The latter, according to Jennings,² resemble aphthous ulcers. Starr states³ that in the majority of his cases of varicella a varying number of pseudo-membranous points were present on the palate, differing from those of variola only by being larger and more yellow in color. There is never any extension or ulcerous development of the pocks. There may be a little sore throat, with temporary pain in deglutition, and sometimes the glands of the throat and neck are slightly enlarged and tender. In varicella no treatment especially directed to the throat is ordinarily called for, but in some cases simple applications may be required.

MEASLES.

In measles both the pharynx and the larynx are usually affected, though not in a serious manner. In the severer cases lesions of the latter, however, give rise to much more trouble than those of the former, and the laryngeal complications undoubtedly constitute one of the chief factors in the comparatively small mortality that is met with in this disease. Whether there occurs in the throat what may strictly be called a prodromal rash or "exanthem of the mucous membrane" has been the subject of considerable discussion among different authorities, but most recent writers unhesitatingly express their conviction of its real existence, especially as regards the palate, and of its value as a diagnostic sign.⁴ There may be merely a diffused redness upon the mucous membrane, but the characteristic "end-anthem," claimed by some authors to be almost uniformly present, is a blotchy or punctate rash upon the palate and uvula, which can sometimes be defined also upon the tonsils, posterior palatine folds, and pharynx, and which makes its appearance antecedently to the cutaneous efflorescence, the period between the development of the two eruptions varying from a few hours to three days. A catarrhal inflammation affecting the air-passages from the nostrils to the bronchi, whether this is preceded or

¹ Ziemssen's *Cyclopædia*, vol. ii. p. 21.

² Keating's *Cyclopædia of Diseases of Children*, vol. i. p. 761.

³ Goodhart's *Diseases of Children*, p. 243.

⁴ Bohn, *Pepper's System of Medicine*, vol. i. p. 464; Hardaway, *ibid.*, p. 465; Goodhart, *op. cit.*, p. 158; Meigs and Pepper, *Henoch*, Starr (*Goodhart's Diseases of Children*, p. 178); Secrétan, *Revue Médicale de la Suisse Romande*, March 20, 1888; *Journal of Laryngology and Rhinology*, January, 1889; Cohen, *op. cit.*, p. 109.

accompanied in its early stages by the spotted appearance that has been mentioned or not, is one of the constant and characteristic features of measles. It usually makes its appearance with the stage of invasion, though the throat may not become involved until some time has elapsed, and it does not subside until the cutaneous rash begins to fade. In the pharynx, while in some cases there is more or less soreness and pain in deglutition, the redness is never so intense nor the swelling of the parts so marked as in scarlatina. In exceptional instances, however, the inflammation extends into the Eustachian tube, and occasionally there is enlargement of the tonsils, accompanied with slight tumefaction of the glands behind the jaw, though suppuration is rarely met with. In a few cases of unusual severity there may be a fibrinous exudation in some portion of the pharynx.

In most cases of measles there is probably a slight catarrhal inflammation of the larynx. Ordinarily, however, the affection is so mild as to give rise to little or no trouble. In bad cases of the disease this organ is apt to suffer more than any other part of the throat. In a number of cases examined with the laryngoscope by Stoffella and von Ziemssen a deep uniform redness of the mucous membrane of the larynx, with a yellow-reddish color of the vocal cords, was found.¹ With the redness, which differs in degree in different cases, there may be thickening and softening of the mucous membrane, and even this simple form of laryngitis sometimes gives rise to more or less marked symptoms of stenosis. When it is more intense it is sometimes accompanied by abscess and ulceration, which may also involve the epiglottis. Coyne describes two varieties of ulcerations,—necrotic inflammation, confined to the mucous membrane of the vocal cords, and suppuration of the mucous glands, especially upon the ventricular bands and along the arytenoid cartilages.² According to Gerhard, the ulcers occur preferably upon the posterior wall of the larynx, and are due partly to the mechanical irritation of the loosened mucous membrane produced by the frequent motion from coughing.³ Such ulcerations, which are met with at times even in the prodromal stage, may give rise to œdema, and Cohen calls attention to the fact that this complication is liable to be mistaken for croup, in which case operative interference may be delayed until there is no chance of saving the patient's life. In the laryngitis of measles in young children spasm of the glottis, or false croup, is a symptom occasionally met with. In measles, as well as in scarlatina, small-pox, and other febrile diseases, true croup, or pseudo membranous inflammation of the larynx, sometimes occurs (generally late in the attack) without the agency of the specific infection of diphtheria. The latter disease is also liable to occur as a complication, affecting either the pharynx or the larynx, or

¹ *Wochenblatt der Gesellschaft der Wiener Aerzte*, 1862, iii. 154; Ziemssen's *Cyclopædia*, vol. iv. p. 201.

² Cohen. *Diseases of the Throat*, p. 110.

³ Ziemssen's *Cyclopædia*, vol. ii. p. 92.

both. Von Ziemssen states¹ that the stenosis from false membranes in the larynx rarely reaches such a height as to require operative interference, and that in some twenty cases of laryngeal diphtheria (in which term he seems to include cases of both croup and true diphtheria) he has never found it necessary to operate. This experience, however, is not in accord with that of some other authorities, and J. Lewis Smith, as previously stated, has seen dangerous stenosis from this cause much more frequently in measles than in scarlatina. Why this should be so it is difficult to explain, unless on the ground that, while the latter disease has a special predilection for the pharynx, measles has a similar tendency towards the larynx. Thus, Loeri states² that inflammatory changes are always more marked in the larynx than in the pharynx, and Hardaway³ asserts that some degree of laryngitis is an accompaniment of *all* cases of measles.

In the severer forms of laryngitis without pseudo-membranous exudation, according to Thomas, the cough is dry and rough, exceedingly frequent and spasmodic, almost incessant; the voice is often very hoarse; the larynx is painful in coughing, speaking, or swallowing, and is the seat of a burning sensation; a rough, whistling respiratory murmur is audible on auscultation, and often even at some distance; at times, especially with violent, incessant, irritating coughing, or when drinking, there occur suffocative spasms, and a painful sense of oppression (Mertens); and such attacks are specially induced by the presence of inspissated and very irritating deposits of mucus upon the laryngeal mucous membrane.

Among the complications of measles may be mentioned gangrene of the larynx, which occasionally occurs in connection with gangrene of the mouth. It is observed chiefly in children in eleemosynary institutions, and, as Flint and Welch suggest,⁴ other morbid conditions than those belonging to measles are presumably concerned in its causation. Now and then suppurative otitis occurs from the extension of inflammation from the pharynx. According to Loeri, follicular ulcers of the larynx always give a bad prognosis, since the cases usually succumb to tuberculosis.⁵ In regard to the prognosis when diphtheritic deposits take place here, Ingals asserts⁶ that four-fifths of the patients die. Chronic enlargement of the tonsils is sometimes met with as a sequel of measles, and Cohen⁷ mentions as an occasional sequel of the laryngitis incident to the disease the organization of the catarrhal inflammations, with the result of producing chronic hoarseness, and occasionally the development of papillomatous excrescences within the larynx.

¹ Op. cit.

² Berliner Klinische Wochenschrift, No. 13, 1882.

³ Op. cit., p. 571.

⁴ Op. cit., p. 1067.

⁵ Pepper's System of Medicine, vol. i. p. 573.

⁶ Op. cit., p. 424.

⁷ Op. cit., p. 110.

Treatment.—Cleanliness of the parts is often all that is required. If the catarrhal pharyngitis or laryngitis is severe enough to call for interference, the treatment employed should be that for idiopathic inflammation in these parts. Since aural complications are due to extension of inflammation from the oral and nasal cavities, Spencer urges the importance of early and systematic treatment of the pharyngeal mucous membrane, and he advises astringent applications, such as Monsel's solution one part to four parts of glycerin;¹ and Hardaway thinks ointments of boric acid, zinc, or iodoform are useful when introduced through the nostrils.² If muco-purulent matter forms in the fauces, astringent and antiseptic gargles, sprays, or injections should be constantly employed, as in scarlatinal angina; and if pseudo-membranous exudation occurs, the case should be managed as one of primary diphtheria or croup.

Goodhart³ is of opinion that much may be done to avert the onset of membranous laryngitis if the throat and fauces be painted energetically with a solution of boric acid, or borax and glycerin, every hour or two, whenever the cough becomes croupy in character. Gangrene should be treated by the local application of strong hydrochloric or nitric acid, or other escharotic, and the adoption of appropriate constitutional measures, and any other complications that may arise should be treated in the same way as similar conditions due to other causes.

RÖTHELN, OR GERMAN MEASLES.

In a comprehensive article on this affection in Keating's *Cyclopædia of the Diseases of Children*,⁴ Dr. William A. Edwards states that Park has observed that the eruption is often seen first on the roof of the mouth. Heim is further of the opinion that there may be in this disease a local eruption; and the case recorded by Reed, in which the eruption appeared only upon the tonsils and velum palati, no cutaneous rash whatever manifesting itself, gives strength to the statement. Edwards found more or less sore throat present in every one of his cases. Enlargement of the tonsils was very frequent, and many of the cases also presented marked pharyngitis and dysphagia. Hardaway also states that the fauces are injected and the tonsils red and swollen.⁵ While this has been the experience of almost all writers on the subject, Park limits sore throat to twenty per cent. of the cases. Edwards expresses the opinion that the condition of the throat in this disease is of marked diagnostic importance, but it will be found in practice that while it may not generally be difficult to make a differential diagnosis between rötheln and measles from the appearances

¹ Pepper's *System of Medicine*, vol. i. p. 581.

² *Ibid.*

³ *Op. cit.*, p. 170.

⁴ Vol. i. p. 691.

⁵ *Op. cit.*, p. 586.

presented by the faucial mucous membrane, it will not by any means be always easy to distinguish between r  theln and scarlatina by the throat alone.

Thomas declares¹ that a somewhat congested condition of the mucous membrane of the palate is never absent. If this also appears in some measure confined about single foci, instead of being equally distributed over the palate, it is yet far removed, he says, from affording so typically spotted a picture as the skin offers. Upon the skin there is no sign of hyper  mia between the individual spots, but the mucous membrane is more or less affected as a whole. While in children the reddened portions of membrane are distributed irregularly in streaks and spots, in adults one is apt to find upon a universally injected membrane single spots of a deeper red. The mucous membrane of the pharynx is almost always injected, if not inflamed, and Edwards and others have found in some cases an eruption scattered over the throat similar to that described by Thomas.² The larynx is sometimes slightly inflamed, and more or less severe hoarseness, though never met with by J. Lewis Smith,³ has been noted by Thomas, Emminghaus, Griffith, Aitken, Cheadle, Paterson, Edwards, and others.² Loeri⁴ describes the mucous membrane of both the pharynx and the larynx as presenting a spotted or uniform hyper  mia, and, according to Liveing,⁵ the sore throat is apt to persist after the subsidence of the rash. Roberts also states⁶ that this is usually the last symptom complained of, and sometimes continues for several days after the eruption has disappeared. In connection with the angina there is almost uniformly more or less swelling of the cervical and post-cervical glands. Diphtheria may be a complication, if that disease is prevalent in the community; otherwise pseudo-membranous exudation can hardly occur.

Treatment.—As a rule, no local treatment of the throat is called for, and at most only that which is appropriate in mild cases of pharyngitis, since the inflammation of the parts rarely or never results in suppuration or ulceration.

MUMPS.

In mild cases of mumps there is usually very little involvement of the pharynx and none of the larynx. Not infrequently, however, there is dryness of the throat, with slight soreness, and on examination there will be found a little redness of the faucial mucous membrane, which may extend over the pharynx, but without true inflammation. In the severer cases where one or both submaxillary glands, with the neighboring lymphatic glands, are involved, and the tumefaction about the neck and face is con-

¹ Op. cit., p. 142.

² Keating's Cyclop  dia of Diseases of Children, vol. i. p. 695.

³ Treatise on the Diseases of Infancy and Childhood, Philadelphia, 1890, p. 331.

⁴ Jahrbuch f  r Kinderheilkunde, xix. Bd.. 1. Heft.

⁵ Pepper's System of Medicine, vol. i. p. 586.

⁶ Op. cit., p. 175.

siderable, there is often œdema of the submucous tissue of the pharynx, with enlargement and inflammation of the tonsils. Under these circumstances deglutition is painful and difficult, and there may be more or less obstruction to respiration. In very rare instances this becomes so extreme that suffocation is imminent.¹ The œdema may even invade the larynx, thus adding to the obstruction in the air-passages, and in April, 1890, M. Pilatte reported to the Marseilles Medical Society² a case of this kind, in a man twenty-nine years of age, in which tracheotomy was necessitated. When the parotid acquires a considerable size, he remarked in connection with the case, it is certain that it may exercise pressure on the large venous trunks of the neck, particularly the external and internal jugular veins; and as it is to the latter vein that the veins of the larynx carry the blood from that organ, the occurrence of venous stasis in the larynx is rendered easy. In connection with abscess of the pharynx a swelling of the lymphatic glands in the region of the parotid, and possibly of the parotid itself, sometimes occurs, and hence Cohen calls attention to the liability to mistake this affection for mumps.³

In regard to the treatment of the pharyngeal and laryngeal complications of this disease, it is only necessary to say that no interference whatever is ordinarily called for (as the symptoms rapidly disappear with the subsidence of the parotitis) unless serious œdema should occur,—in which case the condition should be treated in the same way as œdema occurring from other causes.

ERYSIPELAS.

Erysipelas of the pharynx or larynx, or of both, occurs in connection with cutaneous erysipelas, and also as an independent affection. It is only within the last few years, however, that the latter has been recognized, though Trousseau and Todd were of the opinion that many cases of facial erysipelas had their origin in the fauces.⁴ The so-called idiopathic erysipelas of the throat is not a common affection, but a large number of cases of it have now been placed on record. The disease most frequently reaches the larynx from the pharynx, but the former organ may be primarily affected while the pharynx remains healthy.⁵ While erysipelas of the throat may be confined to the respiratory tract, it may also extend from thence to the skin, and many of the cases of facial erysipelas in which no point of origin can be found and which were formerly believed to be idiopathic are to be explained in this way. On the other hand, the erysipelatous process sometimes extends from the skin to the mucous membrane.

Cornil makes three divisions of erysipelas of the throat: (1) erysipelas

¹ Sydney Ringer, Reynolds's System of Medicine, vol. i. p. 207.

² Journal of Laryngology and Rhinology, August, 1890.

³ Op. cit., p. 697.

⁴ Ziemssen's Cyclopædia, vol. ii. p. 458; Bartholow's Practice of Medicine, p. 791.

⁵ Delavan, New York Medical Journal, September 12, 1885.

with simple redness, in which there is a diffused inflammation and the tissues are of a livid red and shining appearance, with more or less swelling; (2) with phlyctenulæ, in which vesicles appear, ranging from the size of a pin's head to half an inch in diameter,—having the appearance of herpes, and filled with serum or pus,—which, rupturing, leave yellowish-white patches of soft tissue that are easily torn from the tissue beneath; (3) terminating in gangrene, in which there is a dark pultaceous appearance, with a gangrenous odor.¹ Flint and Welch state² that epidemic erysipelatous fever, commonly known as “black tongue,” prevailed extensively in this country between 1841 and 1846. According to Dr. Bennett, of Bridgeport, Connecticut, who made a careful study of the disease, pharyngitis was at once or speedily developed, and this local affection was constant. Not infrequently it was attended with great swelling of the tonsils, and sometimes sloughing occurred. The inflammation sometimes also invaded the larynx, and in a certain proportion of cases death was due to either laryngitis or œdema of the glottis.³ In three almost simultaneous cases of cutaneous erysipelas in one family seen by Strümpel⁴ the disease commenced in the pharynx, and Fagge states⁵ that during epidemics of erysipelas in hospitals it is no uncommon thing for cases of sore throat to occur which are evidently of the same nature, but in which the skin remains unaffected. When erysipelas of the pharynx occurs from extension of the inflammation from without, this may take place through any of the mucous tracts by which the pharynx is connected with the cutaneous surface, and when the disease originates in the pharynx it may pass outward to the integument in the same manner. Sometimes there is an interchange between external erysipelas and erysipelas of the pharynx or of the larynx in the form of a metastasis.⁶ In rare instances the disease appears simultaneously in the pharynx and on the integument; and a case of this kind is reported by Lennander, of Sweden,⁷ the skin over the parotid region being the starting-point of the external attack.

It may now be regarded as established that the Fehleisen micrococcus is the specific microbe of erysipelas, and in cases where the disease originates in the throat it follows that this morbid agent must be introduced from without. Whether it is true or not that a local exciting cause, as well as the presence of the specific microbe, is necessary for the production of the disease, is as yet uncertain, and is, indeed, a matter that will always be exceedingly difficult of proof. Billroth and other authorities, however, hold that it is very doubtful whether erysipelas ever develops except from a

¹ Archives Générales de Médecine, 1862; Keating's Cyclopædia of Diseases of Children, vol. ii. p. 420.

² Op. cit., p. 994.

³ American Journal of the Medical Sciences, January, 1844.

⁴ Op. cit., p. 58.

⁵ Op. cit., p. 270.

⁶ Cohen, op. cit., p. 113; Porter on the Larynx and Trachea, Dublin, 1837, p. 95.

⁷ Journal of Laryngology and Rhinology, November, 1889, p. 464.

wound or from some pre-existing cause of inflammation,¹ but if this be so the lesion of the mucous membrane in primary erysipelas of the throat must often be extremely slight; for in many, perhaps most, of the cases thus far reported no such lesion has been reported.

Erysipelas of the pharynx usually commences with difficulty of deglutition, associated with a feeling of constriction, or with stinging pain in the throat, and accompanied or followed by high fever (the temperature sometimes rising as high as 104°), which may last for a day or two before the efflorescence appears on the mucous membrane. When this occurs there is apt to be a temporary decline in the pyrexia, which again increases when the eruption is thoroughly developed. In this affection the pathological processes are essentially the same as in erysipelas of the skin. On the swollen and glistening surface of the mucous membrane, which appears as if varnished, there may or may not be found vesicles filled with serum, blood, or pus, which are liable to become ruptured, thereby exposing spots, varying in size, of softened yellowish-white tissue. In the worst cases, as previously stated, the inflammation may result in gangrene, large patches of surface losing their vitality and showing as greenish-black, insensitve tracts. There is almost always marked difficulty in swallowing, which is due partially to the pain and partially to paralysis of the muscles. When the palatine muscles are alone affected, regurgitation takes place through the nose, and when the pharyngeal muscles are alone involved, it takes place through the mouth, on attempted deglutition.² The tonsils are almost always more or less affected, but sometimes are not enlarged to any appreciable extent; in other instances they are enormously swollen. In a case related by Delavan³ there was a distinct limitation of the disease to the tonsil for a period of three days. The inflammatory process is liable to extend to the mucous membrane of the nasal, frontal, and Highmorian cavities,⁴ and also of the Eustachian tube. When the latter occurs, more or less serious disease of the ear often follows. Thus, in two cases reported by Lennander⁵ severe otitis media resulted, with extension of the erysipelas to the external ear in both instances and perforation of the membrana tympani in one. In almost all cases the submaxillary and cervical glands are enlarged. When recovery takes place, the inflammation in the throat usually subsides by resolution, but occasionally abscess results, or the parts may be left in a state of ulceration. A possible complication or sequela may be meningitis, as in Delavan's case,⁶ where the affection was at first acute and afterwards passed into the chronic form, with the development of permanent insanity.

¹ Heath's Dictionary of Practical Surgery, Philadelphia, 1886, vol. i. p. 476.

² E. F. Ingals, Keating's Cyclopædia of Diseases of Children, vol. ii. p. 421.

³ Op. cit.

⁴ Ziemssen's Cyclopædia, vol. ii. p. 443.

⁵ Op. cit.

⁶ Op. cit.

There are probably very few cases of pharyngeal erysipelas which do not involve the larynx to a greater or less extent, and this constitutes, indeed, the principal danger to which the patient is subject. Massei describes the objective symptom of the disease as being a marked swelling of the mucous membrane, involving the epiglottis, the ary-epiglottic folds, and the inter-arytenoid space, and causing dyspnoea, dysphagia, and aphonia. The swelling often migrates, decreasing on one side and increasing on the other, while blood and pus are occasionally poured forth from spontaneous rupture of the mucous membrane. The onset is generally sudden, and the laryngoscope shows such intense swelling that the interior of the larynx cannot be demonstrated.¹ In Mackenzie's case quoted by Porter in a paper published in the Transactions of the American Laryngological Association for 1880 it is stated that the epiglottis and arytenoid cartilages were acutely inflamed, and the ventricular bands swollen and covering the vocal cords, which as far as could be seen were injected.

In Miller's case reported in the same paper the laryngoscopic examination showed œdema of the mucous membrane covering the supra-arytenoid and cuneiform cartilages and diffuse scarlet redness extending to all the surrounding parts; and Cohen² describes the interior of the larynx in general as red, lustrous, and tumefied, with more or less manifestation of sub-mucous infiltration. The inflammatory process, he says, soon terminates in extensive suppuration, diffuse abscess, and sloughing, involving the intra-laryngeal and peri-laryngeal structures, as well as the epiglottis and other cartilages and the trachea. There is always great danger to life, not only through the local complications, such as œdema, but on account of general disorders caused by the disease,—pneumonia, pulmonary œdema, heart-failure, general toxæmia, and cerebral adynamia.³ After death the mucous membrane is found intensely œdematous, or even infiltrated with pus, and ulcerations are common. In the case of Mackenzie referred to, the membrane covering the epiglottis and arytenoid cartilages was swollen and ulcerated, while throughout the whole extent of the larynx and trachea, and even far down the bronchi, it was of a bright red color. On the outer side of the larynx there were several small abscesses and great infiltration. In a case of Jules Simon the epiglottis, larynx, vocal cords, trachea, and bronchi as far as their first divisions appeared as red as if soaked in blood, but free from secretion; and in one dissected by Lewin there was found swelling of the aryteno-epiglottic folds and of the posterior folds of the larynx, with intense redness of the vocal cords.⁴ In a case reported by Merrigan, in which intubation was followed by tracheotomy, the autopsy showed necrosis of the cricoid cartilage and complete stoppage of the air-passage by the extreme swelling of the epiglottis and the ary-epiglottic

¹ Rivista Clinica e Terapeutica, No. 1, 1885; Delavan, op. cit.

² Op. cit., p. 436.

³ Sajous, Hare's System of Therapeutics, vol. ii. p. 477.

⁴ Ziemssen's Cyclopædia, vol. ii. p. 459.

folds.¹ Pneumonia or broncho-pneumonia, due to extension of the inflammation through the trachea and bronchial tubes, is a frequent complication of erysipelas of the larynx. Cases of this kind have been reported by a large number of observers, including Peter, Trousseau, Labbé, Jules Simon,² Delavan,³ H. Marais,⁴ and F. H. Collins.⁵

Erysipelas of the pharynx or larynx, or of both, occurs sometimes as a complication of small-pox, typhus and typhoid fever, and other febrile diseases. In cases of cutaneous erysipelas both the larynx and the pharynx are very frequently slightly affected. Zuelzer states⁶ that the mucous membrane of the pharynx is found, in erysipelas of the head and face, for instance, generally hyperæmic and swollen, and Mackenzie,⁷ that in erysipelas of the head and neck there is always more or less congestion of the laryngeal mucous membrane, while even when the disorder is seated on the limbs there is sometimes sympathetic or concomitant inflammation of the larynx. On account of the mildness of the lesions present, however, such cases can hardly be said to amount always to true erysipelatous inflammation. Among sixty-five cases in Wunderlich's clinic Blass saw pharyngitis in thirty-two, but in nine cases only was the trouble sufficiently severe to cause difficulty in swallowing, while in these there were no other serious general symptoms;⁸ and in four cases of facial erysipelas examined by Semeleder with the laryngoscope, while there was found inflammatory redness and swelling of the epiglottis and larynx down to the vocal cords, there was no dyspnœa nor dysphonia.⁹ The apparently sympathetic nature of the throat-trouble in Semeleder's cases was shown by the fact that the inflammatory symptoms in the larynx disappeared gradually with the desquamation of the skin, while in one instance a relapse of the cuticular affection was accompanied by a recurrence of the laryngeal inflammation. Ziemssen also states¹⁰ that in erysipelas when it affects the head laryngeal catarrh is not uncommon. There is nothing peculiar about the complication, he says, except that not very infrequently the ary-epiglottic folds become slightly œdematous; but among several hundred cases of erysipelas of the face and head he has not seen a single instance in which the laryngeal stenosis was at all alarming.

In erysipelas of the throat unaccompanied by any external manifestation of the disease the diagnosis is attended with considerable difficulty. Massei lays stress on the early occurrence of high fever, which varies as in

¹ Medical Record, New York, October 6, 1888.

² Ziemssen's *Cyclopædia*, vol. ii. p. 460.

³ *Op. cit.*

⁴ *Année Médicale de Caen*, May 14, 1888.

⁵ *British Medical Journal*, May 9, 1891.

⁶ Ziemssen's *Cyclopædia*, vol. ii. p. 459.

⁷ *Op. cit.*, p. 457.

⁸ Ziemssen's *Cyclopædia*, vol. ii. p. 459.

⁹ Mackenzie, *op. cit.*

¹⁰ Ziemssen's *Cyclopædia*, vol. iv. p. 201.

ordinary erysipelas, on the appearance of dysphagia as the first symptom, which he attributes to swelling of the mucous membrane which starts from the adenoid tissues at the base of the tongue and soon reaches the epiglottis and ary-epiglottic folds, on the sudden development of œdema of the larynx from the rapid extension of the swelling, and on the severe general prostration. He considers that there are two forms of the affection, one in which the local symptoms, such as dysphagia and laryngeal œdema, predominate, and one in which the general symptoms, such as adynamia and pneumonia, are more prominent.¹ In his former article Massei² bases his diagnosis of primary erysipelas of the larynx on the following points: 1, its rapid development and its tendency to wander, as well as its predilection for parts in which the lymphatics are abundant; 2, the constitutional symptoms, which resemble those of erysipelas; 3, its want of resemblance, from its migrating character, to the ordinary forms of laryngitis; 4, the tendency of the disease to extend to the lungs; and, finally, its occurrence during the course of epidemics of erysipelas. He also expresses the opinion that many cases reported as primary œdema of the larynx are in reality cases of erysipelas.

If the disease is confined to the pharynx the diagnosis may be more difficult. In ordinary catarrhal sore throat, however, the symptoms are not usually so severe, the pain is less, the redness not so vivid, and the swelling not so great. The appearance of the characteristic erysipelatous blush at the orifice of the nostrils would, of course, establish the diagnosis.³ In erysipelas of both the pharynx and the larynx a valuable aid to diagnosis is furnished by the Fehleisen micrococcus, as the presence of this microbe will at once determine the nature of the attack. In four cases of primary erysipelas of the throat reported by G. Gordone the discovery of the Fehleisen micrococcus in each instance confirmed the diagnosis.⁴

Treatment.—Internally the tonic and supporting treatment appropriate to erysipelas in general should be employed, the free use of stimulants being required in some cases. Some cases seem to have been cut short by the local use of a strong solution of nitrate of silver (sixty grains to the ounce) applied so as to cause a margin of unaffected structures, as recommended by Cohen.⁵ In a case recorded by Gibb⁶ the application of a solution of nitrate of silver of the strength of eighty grains to the ounce every six hours repressed a commencing supraglottic œdema, the patient being out of danger within forty-eight hours. Experience has shown that the energetic use of ice, applied both externally and internally, constitutes one of the most valuable measures at our command, especially in the early

¹ Wiener Klinische Wochenschrift, April 20, 1890.

² Op. cit.

³ T. Pickering Pick, Heath's Dictionary of Surgery, vol. i. p. 84.

⁴ Annales des Maladies de l'Oreille, etc., February, 1889, p. 118.

⁵ Keating's Cyclopædia of Diseases of Children, vol. ii. p. 421.

⁶ Op. cit., p. 232.

stages of the disease. Later, hot sedative inhalations, such as are appropriate in ordinary inflammatory conditions, will often prove of service. To alleviate the pain Sajous employs locally a ten-per-cent. solution of cocaine in mint-water.¹ For the general effect upon the disease, however, he relies principally on a mixture containing ten minims of tincture of aconite and two drachms of tincture of chloride of iron to three ounces of glycerin and water. Of this a teaspoonful is given every half-hour until the temperature and pulse are influenced, and after that every hour. He believes that it has a most beneficial local effect, and states that the continuous action thus obtained generally limits the duration of the inflammatory process. He refers to Bedford Brown's article in the *Journal of the American Medical Association* quoted in the *Annual of the Universal Medical Sciences* for 1888, in which the latter insists upon the importance of counter-irritation applied to the neck and chest, "for the purpose of inducing a migration of the inflammation," and says that he himself would be inclined to choose the region of the liver as the seat of counter-irritation; basing this selection upon the remarkable results obtained by the same procedure in the treatment of epistaxis. Various astringents besides tincture of iron, such as alum and tannin, are sometimes used with good effect in gargles or sprays, and in some cases disinfectants, like boric acid and chlorate of potassium, are especially called for. Inhalation of bichloride of mercury is a favorite measure with Massei.² The hypodermic injection of muriate of pilocarpine, which he has seen produce excellent results in facial erysipelas, has been advised by Cohen. Sajous states³ that the headache, which is usually quite marked, can be greatly benefited by snuffing up one-eighth of a grain of morphine every two or three hours. When the larynx is attacked he recommends digitalis, as tending by its diuretic action to diminish the tendency to œdema of both lungs and larynx and to keep the heart's action strong and diminish the likelihood of albuminuria. He considers iodoform, given in one- or two-grain pills every two hours, of great value in preventing toxæmia. Locally he employs cocaine in a twenty-five-per-cent. solution, and he states that when laryngeal œdema is present this is often sufficient to reduce it and keep it down. Ryland and Gross advise leeches externally followed by the application of blisters, in young and robust subjects, and Bedford Brown observed that their free employment was followed by immediate reduction of laryngeal stenosis. Emetics may sometimes prove of service, and if œdema persists, free scarification should be practised. If this fails, intubation may be resorted to with some hope of success. The last resource is tracheotomy, which, unfortunately, is rarely successful in averting a fatal issue.

¹ Hare's System of Therapeutics, vol. ii. p. 453.

² Journal of Laryngology and Rhinology, December, 1890, p. 532.

³ Op. cit.

INFECTIOUS ANGINAS WITH MARKED FEBRILE MOVEMENT.

From time to time there are recorded in medical literature cases of angina, differing from ordinary pharyngitis and laryngitis, in which the throat-lesions are evidently the local manifestations of a constitutional infection. The late Dr. Austin Flint described¹ an epidemic febrile affection characterized by erythematous pharyngitis as a constant feature which prevailed in Western New York in 1857 and in New York City in the spring of 1864. A considerable number of cases of infectious angina, frequently characterized by phlegmonous inflammation and sometimes resulting in œdema of the glottis or larynx, have been reported by various observers. An œdematous form of throat-disease with frequent glandular enlargement sometimes involving the larynx and in some instances attended by ulceration or suppuration, which was epidemic in the Mississippi Valley for two years, is described in a paper read by Dr. Glasgow, of St. Louis, before the American Laryngological Association in 1889.² In 1890 Simanovski, of St. Petersburg, reported in *Wrach* six cases of epidemic ulcerative inflammation of the pharynx.³ In 1888 Senator⁴ published a paper on acute infectious phlegmon of the pharynx, which he described as an acute febrile disease with marked dysphagia and enormous swelling of the cervical glands and the whole neck, in which death quickly results from involvement of the larynx. At the autopsy there is always found a diffuse purulent inflammation of the pharynx (which is propagated to the larynx), and of the glands, and sometimes of other organs. His observations were based on four cases. Similar cases are reported by Landgraf,⁵ Hager,⁶ Baruch,⁷ and Germonig,⁸ in 1888, by Schwartz,⁹ in 1889, by Cerlot and Merklen,¹⁰ in 1890, and by Rendu and Hanot,¹¹ in 1891. In Rendu's case an abscess formed in the subcellular tissue about the larynx and œsophagus, and this was followed by basic pulmonary congestion and paralysis of the phrenic and pneumogastric nerves. The diaphragmatic paralysis lasted for six weeks. In Hanot's case the pharyngeal inflammation was followed by empyema, and, although this was operated on, the patient died fifty days after the onset of the affection. At the autopsy

¹ Flint's Principles and Practice of Medicine, Philadelphia, 1866, p. 335; Buffalo Medical Journal, vol. xii. p. 718.

² Journal of Laryngology and Rhinology, August, 1889, p. 346.

³ Ibid., August, 1890.

⁴ Berliner Klinische Wochenschrift, No. 5, 1888.

⁵ Ibid., No. 6, 1888.

⁶ Ibid., No. 12, 1888.

⁷ Ibid., No. 13, 1888.

⁸ Wiener Klinische Wochenschrift, December 6, 1888.

⁹ Annales des Maladies de l'Oreille, etc., July, 1889.

¹⁰ Ibid., February, 1891.

¹¹ Société Médicale des Hôpitaux, May 15, 1891; Journal of Laryngology and Rhinology, November, 1891.

small abscesses were found in the tonsils, and the retro-pharyngeal cellular tissue was the seat of a purulent process which had found its way through the parietal pleura and extended to the pleural cavity. Most of these cases proved fatal, and Landgraf believes that in this affection death is often due not so much to œdema of the glottis as to paralysis of the heart, such as occurs sometimes in diphtheria.

The question of the real nature of these cases of infectious angina is a very interesting one, and the opinion is gaining ground in the profession that they are best explained on the hypothesis that they are for the most part of erysipelatos origin. In the epidemics referred to by Flint it is uncertain whether this was the case, and if the affection was of this character it must have been a very mild type of erysipelas. He states that it resembled influenza, save that the pharyngeal and not the bronchial mucous membrane was the seat of the local manifestation, but he leaves the point unsettled whether it was influenza or epidemic erysipelas, such as is popularly known as black tongue. In regard to the affection described by Glasgow, he himself was inclined to the opinion that it was probably influenza. From the fact that in some of the cases there were patches of exudation in different parts of the throat, some of the speakers who took part in the discussion of the paper considered it of a diphtheritic nature, while Dr. Delavan expressed the opinion that the disease was analogous to that described by the older French authors and Sir Morell Mackenzie as acute œdematous laryngitis and more recently by Senator under the name of acute infectious phlegmon of the pharynx.¹ In 1885 Massei² published an elaborate article in which he endeavors to prove, from a study of thirteen cases, that the so-called primary œdema of the larynx, or phlegmonous laryngitis, corresponds clinically to a localization of erysipelas in the larynx. In the *Annual of the Universal Medical Sciences*³ for 1889, Cohen states that some observers have not hesitated to assert that non-traumatic œdema of the larynx is always the result of erysipelas, and that acute phlegmon of the larynx is likewise as frequently attributed to this disease. In this connection he refers to the case of Germonig, in which at the autopsy thick green pus was found in the epiglottis, extending through the entire submucous tissue of the cartilage, with reddening of the laryngeal mucous membrane, while purulent exudation was found in the pleuræ and pericardium, and the liver, spleen, and kidneys were swollen. In the same periodical⁴ Delavan refers to the paper of Senator, previously mentioned, in which he describes acute infectious phlegmon of the pharynx as a rare and heretofore unrecognized condition, and states that in the discussion upon it it was shown by Virchow, Guttman,

¹ *Journal of Laryngology and Rhinology*, August, 1889, p. 347.

² *Rivista Clinica e Terapeutica*, No. 1, 1885; Delavan, *op. cit.*

³ Vol. iv., 1889, G 5.

⁴ Vol. iv., E 2.

and Sonnenburg that the disease was not so rare as Senator had claimed, that it had been described by many writers, especially by the French, and that it was a condition similar to that described by Mackenzie as acute œdema of the pharynx and larynx accompanying erysipelas of these parts. At a meeting of the Société des Hôpitaux, November 7, 1890, Merklen,¹ in narrating two cases of infectious phlegmon of the pharynx and larynx, also expressed the opinion that this disease as described by Senator was not new, and stated that it was the submucous laryngitis of Cruveilhier, the acute phlegmonous laryngitis of Sestier. Not only was there dysphagia, (the initial symptom), rapidly followed by dyspnoea, he said, but, in addition, the pus, the albuminuria, and the enlargement of the spleen which constitute the habitual features of acute infectious states. A further confirmation of the supposition that this affection is really due to erysipelas may perhaps be found in the fact that the trouble sometimes starts from a local source of irritation, as in a case reported by Schwartz,² in which the infectious phenomena originated in a dental caries, and one by Chiari,³ in which the epiglottis was wounded by a piece of bone. It should be stated, however, that in the discussion of a paper by Massei on erysipelas of the larynx in the Laryngological Subsection of the Tenth International Medical Congress at Berlin, some of the speakers did not accept the erysipelatous origin of infectious phlegmon of the throat. Thus, Thorner reported one case of erysipelas of the larynx and two of phlegmonous angina, apparently making a distinction between the two forms of disease, and B. Fraenkel expressed the opinion that erysipelas of the larynx and phlegmon are two different affections.⁴ The bacteriological investigation of infectious phlegmon ought to throw much valuable light on the subject, as the cultivation of the microbes found to be present might perhaps settle the question whether the disease is of erysipelatous nature or not. In Hanot's case⁵ streptococci were discovered in the pus from an abscess in the neck and from the empyema during life, and in all the purulent collections found after death.

The phlegmonous inflammation of the connective tissues of the neck known as Ludwig's angina, in which the pharynx and larynx are principally concerned by reason of the pressure exerted upon them by the tumefaction present, also bears some striking analogies to the affection under consideration; and in the discussion at the Tenth International Medical Congress referred to, Semon stated that he believed erysipelas of the larynx, phlegmon of the pharynx, and Ludwig's angina to be merely different forms of the same infection by streptococci. Interesting cases of the latter

¹ Op. cit., *Journal of Laryngology and Rhinology*, March, 1891, p. 115.

² Société de Médecine Pratique, March 21, 1889; *Journal of Laryngology and Rhinology*, July, 1889.

³ *Journal of Laryngology and Rhinology*, December, 1890, p. 532.

⁴ *Ibid.*, 1890, p. 533.

⁵ Op. cit.

affection have been recently reported by Lejars,¹ Bernardo,² and T. Arnallt Jones.³ In the last case the patient was a butcher, and, as there was no local cause for the trouble, Mr. Jones suggests the possibility of his having absorbed or been inoculated with some animal or specific poison.

A case has been reported by Rendu⁴ in which a patient who had slept near two women who had just had pneumonia was suddenly attacked with fever and grave symptoms similar to those of pneumonia or typhoid fever at its commencement. A careful examination revealed only a mild erythematous angina, but pneumococci were found in the saliva. A similar case was observed during the next few days in the same room, and Rendu thinks that this is a well-defined variety of angina, in which the diagnosis offers no difficulty. In commenting on these cases, Joal, quoting the opinion of Netter, says that at the present time we know pneumococcic infection to be revealed in the pharynx in an undoubted fashion under the form of suppurative and pseudo-membranous angina, but it is not proved that pneumococci cause follicular and simple angina.

Before dismissing the subject of infectious anginas, mention should perhaps be made of that form of tonsillitis and pharyngitis associated with more or less severe constitutional symptoms which is due to the septic effect of defective drainage and is sometimes designated by the term "drain sore throat."⁵ At the Inter-Colonial Medical Congress of Australasia Dr. A. Honman read a valuable paper on the correlation of this affection with other zymotic diseases.⁶

TYPHOID FEVER.

In this disease both the pharynx and the larynx are affected in a considerable number of cases, and the lesions in the latter constitute a very serious complication. Various forms of angina, catarrhal, follicular, ulcerative, and croupous or diphtheritic, occur, and aphthous inflammation of the pharynx in connection with the same condition in the mouth is not very infrequent.⁷ Difficulty in swallowing is very often complained of at the beginning of typhoid: this is generally due to dryness of the throat. Later on, dysphagia may be due to muscular paralysis, or, in children, it may be a purely nervous affection. A certain amount of hyperæmia of the faucial and pharyngeal mucous membrane is not uncommon, but actual sore throat is comparatively rare, as a rule, though in some epidemics it has been met with so frequently that some writers regard catarrhal or

¹ *Annales des Maladies de l'Oreille, etc*, January, 1889, p. 44.

² *Correo Médico Castellano*, September 10, 1890.

³ *Lancet*, June 6, 1891.

⁴ *Société Médicale des Hôpitaux*, May 8, 1891; *Journal of Laryngology and Rhinology*, November, 1891, p. 472.

⁵ *Journal of Laryngology and Rhinology*, January, 1890, p. 17.

⁶ *Ibid.*, June, 1890, p. 252.

⁷ *Flint and Welch*, p. 952.

diphtheritic inflammation of the pharynx as a symptom rather than a complication.¹

Bartholow² states that enlargement of the tonsils, the follicles of the pharynx, and the large follicles at the base of the tongue takes place coincidently with the development of the intestinal glandular appendages. In rare cases (so-called tonsillo-typhoid or pharyngo-typhoid) there are seen upon the tonsils peculiar whitish elevations, which later ulcerate, and Strümpel regards these as probably a specific lesion of the tonsils.³ The inflammation of the pharynx may be so severe as to result in ulcerations, especially in the lower portions. Murchison⁴ describes them as having a round, oval, or irregular outline, and ranging in diameter from two lines to three-quarters of an inch. They are usually very superficial, but occasionally their base is formed by the muscular coat. In cases where there is no ulceration the mucous membrane may be found covered with pseudo-membranous exudation, or the submucous tissue is infiltrated with serum. False membranes may form as the result of the supervention of true diphtheria, or, as in scarlatina and measles, without the agency of the specific diphtheritic virus. In the latter case the exudation usually takes place in the third week. The inflammatory process in the pharynx, whether diphtheritic or not, may extend to the Eustachian tube and middle ear, and in the same way it may spread through Steno's duct and set up parotitis. The latter affection may also occur metastatically,⁵ but this complication is less frequent than in typhus.

In an inaugural thesis on the lesions of the pharynx in typhoid, published in Berlin in 1889, Belde states that of one hundred and forty cases of the disease the larynx was involved in sixty-eight. Among the conditions described are hyperæmia, hemorrhage, catarrhal angina, follicular tonsillitis, croupous and diphtheritic exudation, ulceration, and paralysis; and he states that catarrh of the pharynx is as frequent in mild cases as in the graver ones. On the other hand, pseudo-membranous exudation, and even simple ulceration, are rarely met with except in the severer forms of the disease.⁶

The laryngeal complications of typhoid fever appear to be much less frequent in this country than in Germany;⁷ although, according to Ziemssen, modern antipyretic treatment has much diminished their frequency there. The larynx is subject to the same inflammatory processes as the pharynx, which may develop in connection with those in the pharynx or independently of pharyngeal inflammation, and when met with in this

¹ J. H. Hutchinson, *Pepper's System of Medicine*, vol. i. p. 265.

² *Op. cit.*, p. 801.

³ *Op. cit.*, p. 11.

⁴ *Continued Fevers of Great Britain*, London, 1873, p. 609.

⁵ Cohen, *op. cit.*, p. 696.

⁶ *Annales des Maladies de l'Oreille*, etc., July, 1890, p. 491.

⁷ Hutchinson, *op. cit.*, p. 294; Osler, *op. cit.*, p. 23.

location they are in some cases attended with more serious results. Fortunately, however, the graver forms of laryngeal involvement are of comparatively rare occurrence. Ulceration of the larynx in typhoid has long engaged the careful study of pathologists, but there is still a difference of opinion as to whether this is not in some cases, if not all, specifically typhoid. In speaking of this subject, Fagge says¹ that while such ulceration has generally been set down among the primary lesions of this disease, the absence of a specific cell-growth constitutes a distinction which seems important, and the explanation of its occurrence probably lies in some subtle association in morbid tendencies between the larynx, the lungs, and the intestine, of which we have other examples in acute pneumonia and in phthisis. Osler states² that typhoid bacilli have not yet been found in the ulcers; and among those who believe that they are always secondary and not specific lesions of the typhoid process analogous to the intestinal ulcers may be mentioned, in addition to Fagge, Murchison,³ Roberts,⁴ Liebermeister,⁵ Strümpel,⁶ and Bartholow.⁷ Those who take the view that they are due to a specific deposit upon the laryngeal mucous membrane are principally German pathologists. Notable among them are Klebs and Rokitsansky; and to the opinions of the latter Mackenzie subscribes.⁸ In a paper on the laryngeal lesions of typhoid published in 1889, Landgraf describes what he considers to be true typhoid ulcers. He states that in his cases they were found, as in the intestine, only on parts which contain adenoid tissue, and that he observed in one instance an ulceration with a necrotic deposit such as is met with in the intestine.⁹ Ulceration of the larynx, while occurring more frequently in some epidemics than in others, is comparatively rare in the United States, and also, apparently, in England and France. Osler states¹⁰ that he has met with it in only four or five instances, and Murchison¹¹ in but three or four, while, according to Murchison,¹² Louis saw it in three out of ninety-six cases, Chomel in one out of forty-two, and Jenner found it in one out of fifteen cases examined after death. Both Jenner and Louis found ulceration of the pharynx far more common than ulceration of the larynx. In Germany, however, laryngeal ulcers have been noted quite frequently. Hoffmann found these present twenty-eight times in two hundred and fifty autopsies, and Griesinger in twenty-six per cent. of his cases that died. The latter authority, after a comparison of many different reports, estimates that they occur in

¹ Op. cit., vol. i. p. 197.

² Op. cit., p. 633.

³ Ziemssen's Cyclopædia, vol i. p. 166.

⁴ Op. cit., p. 13.

⁵ Op. cit., p. 806.

⁶ Op. cit., p. 458.

⁷ Berliner Klinische Wochenschrift, April 8, 1889.

⁸ Op. cit., p. 23.

⁹ Op. cit., p. 633.

¹⁰ Op. cit., p. 9.

¹¹ Op. cit., p. 168.

•

¹² Op. cit., p. 633.

about one-fifth of the fatal cases.¹ In two thousand autopsies at Munich they were noted in one hundred and seven.²

Grüder, in an inaugural dissertation upon ulcerations of the larynx in typhoid, describes three varieties:³ (1) So-called specific typhoid ulcerations, occurring at the same time as ulceration of the bowel, and only in situations where follicular structures are present, as on the anterior aspect of the posterior wall of the larynx, at the base of the epiglottis, and on the aryteno-epiglottic folds. Bacteriological investigations failed to detect the presence of the typhoid bacillus in these ulcers. (2) Catarrhal manifestations with a tendency to ulceration. The mucous membrane is reddened and swollen, the epithelium desquamates, and erosion takes place. The ulcer may extend down to the cartilage. The catarrhal ulcers seated at the margin of the epiglottis are included in a separate subdivision. They rarely occur singly. (3) Diphtheritic ulcers. Infiltration is succeeded by necrosis and exfoliation.

While the laryngeal complications do not usually develop until later on in the course of typhoid, in rare instances the disease may begin with an affection of the larynx. Two cases of this kind, occurring in children, are reported by Schuster. In one of these the laryngoscope showed thickening of the epiglottis, inflammation of the whole of the laryngeal mucous membrane, thickening of the vocal cords, and a large ulcer on the posterior wall. In the other laryngoscopy was impossible, but there were well-marked symptoms of laryngeal inflammation.⁴ In addition to the locations that have been mentioned, the vocal cords may be the seat of superficial ulceration, and Fagge states⁵ that, as a rule, there is a sharply-defined ulcer over the base of one or both of the arytenoid cartilages. He believes, however, that such an affection very rarely gives rise to any symptoms, though sometimes there is hoarseness or even aphonia. If the vocal cords are attacked, or if the swelling produced by ulceration elsewhere extends to the cords, the voice is almost sure to become rough and hoarse, or perhaps reduced to a whisper. It must be borne in mind, however, that simple catarrhal laryngitis may also give rise to hoarseness. Sometimes a severe cough results, and there may be marked dysphagia. As a rule, according to Liebermeister,⁶ laryngeal ulcers do not in any way affect the ordinary course of the disease, and in favorable cases heal without leaving any evil consequences. In some cases, however, they spread by sloughing and are so deep as to destroy the subjacent cartilages or perforate the larynx, permitting air to escape

¹ Ziemssen's *Cyclopædia*, vol. i. p. 166.

² Osler's *Practice of Medicine*, p. 9.

³ *Centralblatt für Bacteriologie und Parasitenkunde*, Jena, February 17, 1890; *Annual of the Universal Medical Sciences*, 1891, vol. i.

⁴ *Archiv für Kinderheilkunde*, Band xii., Hefte 5 u. 6; *Journal of Laryngology and Rhinology*, May, 1891, p. 211.

⁵ *Op cit.*, p. 197.

⁶ *Op cit.*, p. 166.

into the connective tissue. Chondritis and perichondritis may also lead to the rapid development of œdema of the glottis, with great laryngeal obstruction and impending asphyxia. The cricoid and arytenoid cartilages are the most frequently involved, and the lesion may commence in suppurative inflammation and abscess of the submucous cellular tissue. The posterior surface of the cricoid is often the earliest point of attack, according to Cohen and others, both as a result of gravitation in the recumbent position, it is alleged, and because of its frequent subjection to compression during deglutition,—the process being similar to that occasioning bed-sores from pressure over osseous prominences. Stenosis is likely to result, and the accompanying dyspnoea may be accompanied with stridor or with paroxysmal suffocative spasms.¹ Although the prognosis is very unfavorable in the great majority of cases, recovery may take place in exceptional instances, with probably more or less permanent damage to the larynx. In the only two cases of perichondritis observed by Osler² the patients both got well, one after expectorating large portions of the thyroid cartilage.

Pseudo-membranous exudation in the larynx is an occasional cause of œdema of the glottis and of stenosis from obstruction by the diphtheritic deposit. Erysipelas of the throat also occasionally complicates typhoid fever, and several cases in which death was due to œdema of the glottis resulting from this cause are recorded by Jenner and Trousseau.³ A rare affection that has been met with is laryngitis fibrinosa, and a case of this kind in a child only one year old is reported by Benno.⁴ Tracheotomy was performed, without avail, for increasing laryngeal stenosis, and at the autopsy there was found swelling of the mucous membrane, with much stenosis, while the whole subglottic region was occupied by a white tumor-like mass. Microscopical examination showed it to be a fibrinous exudation into the mucous membrane. Lublinski⁵ has called attention to the fact that paresis of the laryngeal muscles sometimes occurs in the course of typhoid. Various lesions of the epiglottis have been noted, and it was found by Louis to present signs of recent inflammation in ten out of forty-six cases, being œdematous, congested, ulcerated, or covered with false membrane. In all the cases death occurred at an advanced stage of the disease.

Treatment.—In the great majority of cases of throat-lesions occurring in typhoid no special treatment is required; but careful attention should always be paid to cleanliness and to local disinfection from time to time. For this latter purpose may be used combinations of benzoic acid with tincture of eucalyptus, saccharine, or bichloride of mercury, recommended

¹ Cohen, *op. cit.*, p. 527.

² *Op. cit.*, p. 23.

³ Reynolds's *System of Medicine*, vol. i. p. 385.

⁴ *Archiv für Kinderheilkunde*, 1888, Band x., Heft 2.

⁵ Laryngological Society of Berlin, May 15, 1889; *Journal of Laryngology and Rhinology*, June, 1889.

by Miller, of Berlin.¹ In some of his cases Landgraf² found certain yellow spots upon the mucous membrane, and after extirpating specimens of these with a curette he discovered the *staphylococcus pyogenes aureus* of Rosenbach and the *staphylococcus pyogenes flavus*. Catarrhal or ulcerative inflammation severe enough to require active interference should be treated in the same way as similar conditions arising from other causes, and the same may be said of pseudo-membranous exudation and oedema of the larynx. Perichondritis of the laryngeal cartilages, representing an occurrence of great clinical importance, demands the most skilful care. The inflammation, says Rükovitch,³ runs its course exceedingly slowly, but steadily, and, when unrestrained by interference, destroys the organ portion by portion until ultimately causing laryngeal stenosis. According to Lübning's statistics, quoted by Rükovitch, in one hundred and ninety-nine cases of stenosis of various origin there were one hundred and twenty-five deaths. In one hundred and forty-seven tracheotomy was performed, with seventy-seven deaths and seventy recoveries, and in sixty-four of the latter cases the patients were obliged to wear the canula all their lives. Rükovitch adduces a remarkable case of typhoid perichondritis of the cricoid cartilage, and, pointing to the brilliant results obtained in it, and, on the other hand, to the enormous mortality from laryngeal stenosis in general, he lays down the following proposition. In all cases of laryngostenosis arising from perichondritis in the course of typhoid fever, laryngofissure should be performed in order thoroughly to examine and to scrape out the parts, and generally to practise such local treatment as may be indicated by the particulars of the case. In view of the hemorrhagic tendency in typhoid patients, the operation should be performed by means of Paquelin's thermo-cautery.

TYPHUS FEVER.

In this disease the mucous membrane of the pharynx, like that of the mouth, commonly becomes dry and covered with sticky masses of mucus, and this condition may cause more or less difficulty of deglutition. Occasionally dysphagia may be dependent on pathological conditions in the parts anterior to the fauces, as in a rare case reported by Fleisher,⁴ where it was due to necrosis of the hard palate resulting in perforation, which occurred on the fourth day after the crisis. This symptom may also develop in connection with pharyngeal catarrh, which occurs in a certain proportion of cases, though suppuration or ulceration is but rarely met with except erysipelatous inflammation is present. In his careful study of the post-mortem

¹ Journal of Laryngology and Rhinology, September, 1891.

² Op. cit.

³ Transactions of the Third General Meeting of Russian Medical Practitioners at St. Petersburg, 1889, No. 8, p. 269; Journal of Laryngology and Rhinology, June, 1889.

⁴ Vrach, 1891, No. 24, p. 550.

appearances in typhus, Murchison states¹ that the lining membrane of the pharynx occasionally exhibits signs of recent inflammation. It is vividly injected, or of a dusky red hue, and sometimes the mucous follicles are enlarged and contain a puriform fluid, or collections of puriform matter are found in the areolar tissue behind the pharynx. The mucous membrane may be covered with viscid mucus or with diphtheritic flakes. Pseudomembranous exudation is liable to occur either as the result of the super-vention of true diphtheria or independently of this, as in typhoid and other febrile diseases.

Laryngitis is an occasional but serious complication, and of twelve thousand five hundred and sixty-two typhus patients at the London Fever Hospital it was found in twenty-one, of whom eight died.² Murchison has seen it occasionally assume a croupal character. It appears to be more frequent in Germany, as Lebert³ mentions that he has met with it repeatedly, though only as a simple catarrh, accompanied by hoarseness. He states, however, that in many epidemics a diphtheritic croup has often been observed. Ulceration of the larynx is sometimes met with, though it is decidedly more rare than in typhoid. The ulceration, according to Mackenzie,⁴ is generally of the most destructive character, and, whilst it often involves a large surface, it frequently penetrates deeply and exposes the cartilages. It is generally found at the posterior parts of the larynx, and it is commonly thought to be caused, at least in part, by hypostatic influences. The cricoid cartilage is frequently seen to be denuded, and of a blackish-gray color, and there is often a corresponding discoloration of the opposite wall of the pharynx. Other laryngeal conditions which Mackenzie mentions as occasionally met with are congestion of the mucous membrane, plastic deposit on the surface, cedema, and gangrenous inflammation. On the other hand, Murchison states⁵ that the ulcerations of the larynx, which are met with only in exceptional cases, are always minute and superficial. Recent disease of the larynx was observed after death by Jenner in six out of sixteen cases, and by Jacquot in sixteen out of thirty-nine. Murchison⁶ describes the lining membrane as of a bright or dusky red hue, tumid and coated with viscid mucus, diphtheritic flakes, or a puriform fluid. Its texture is softened, and sometimes the mucous follicles are enlarged, while sometimes cedema of the glottis is found. After mentioning that Jacquot observed diphtheritic exudation in two out of twenty-nine cases, he states that the morbid appearances in the larynx are almost always accompanied by inflammation in the pharynx. Cedema of the glottis, which may be very insidious at its commencement, is the chief

¹ *Op. cit.*, p. 249.

² Murchison, *op. cit.*, p. 193.

³ Ziemssen's *Cyclopædia*, vol. i. p. 330.

⁴ *Op. cit.*, p. 457.

⁵ *Op. cit.*, p. 258.

⁶ *Ibid.*

danger to be apprehended in connection with laryngeal disease. While it is rare, according to Ziemssen,¹ for a simple inflammation of the mucous membrane to result in œdema, this often fatal accident is liable to occur at times, and the likelihood of its doing so is increased when the inflammation is of a severe grade, or if there are ulcerations present, especially upon the vocal cords. It appears to be much more frequent in some epidemics than in others. In a paper on "Cedematous Laryngitis Successfully Treated by Scarification of the Glottis and Epiglottis," published in 1848,² the late Dr. Gurdon Buck mentions no less than four cases which occurred in typhus patients at the New York Hospital within a few months. In one of these, in which repeated scarifications were practised, recovery took place, but the other three terminated fatally without scarification being resorted to. Colored plates of the specimens from two of these are appended. The danger of œdema is greatly increased by the occurrence of diphtheritic exudation or erysipelas either in the pharynx or in the larynx. Murchison,³ Roberts,⁴ J. H. Hutchinson,⁵ and others have called attention to the comparative frequency with which erysipelas complicates or follows typhus, and George Buchanan⁶ expresses the opinion that it probably has an intimate connection in nature with the latter.

RELAPSING FEVER.

Roberts⁷ states that in relapsing fever sore throat is frequently complained of, the fauces being reddened, and one or both tonsils being enlarged. According to Pepper,⁸ pharyngitis and tonsillitis of mild grade occur in from three to twenty-five per cent. of the cases, and Welsh⁹ mentions that in the epidemic of 1817-19 in one hundred and eighty-one out of seven hundred and forty-three cases the fauces or tonsils were more or less inflamed, but in most instances the affection was slight. In the severer cases with marked hepatic trouble (the so-called "bilious typhoid" of the Germans), Griesinger states that croupous deposit on the mucous membrane, with hoarseness and difficulty of swallowing, is sometimes developed.¹⁰ Pepper,¹¹ Flint and Welch,¹² Strümpel,¹³ Murchison,¹⁴ and other authors mention laryngitis or œdema of the glottis as an occasional complication. It was observed by Smith in nine out of one thousand cases about the

¹ Op. cit., p. 202.

² Transactions of the American Medical Association, 1848.

³ Op. cit., p. 193.

⁴ Op. cit., p. 139.

⁵ Op. cit., p. 355.

⁶ Reynolds's System of Medicine, vol. i. p. 443.

⁷ Op. cit., p. 157.

⁸ Pepper's System of Medicine, vol. i. p. 405.

⁹ Murchison, op. cit., p. 388.

¹⁰ Ziemssen's Cyclopædia, vol. i. p. 293.

¹¹ Op. cit., p. 403.

¹² Op. cit., p. 33.

¹³ Op. cit., p. 989.

¹⁴ Op. cit., p. 382.

period of crisis.¹ The laryngitis is usually mild, but may assume a dangerous character. Both Begbie and Paterson report cases which required tracheotomy, and Wyss and Boch met with ulcerative laryngitis with perichondritis.²

CEREBRO-SPINAL FEVER.

As a rule, the pharynx and larynx present nothing unusual in their appearance in this disease, though, according to Stillé,³ there seems to be more or less pharyngitis in certain epidemics. In cases where the head is bent far backward by muscular contraction, there is apt to be great difficulty in swallowing, and, as Ziemssen suggests, this is probably because the larynx is firmly pressed against the spinal column by the extreme tension of the anterior muscles of the neck. J. Lewis Smith⁴ has seen two patients that perished early with inability to swallow as the prominent symptom, attended in both by an abundant secretion upon the faucial surface, without any redness, swelling, or other evidence of inflammation. In these cases there was, he believes, a suddenly developed paralysis of the muscles of deglutition.

YELLOW FEVER.

In the invasive stage of this disease sore throat is sometimes complained of, and there is a constant desire for cool drinks or ice.⁵ When the active febrile stage sets in, the mucous membrane of the hard and soft palates becomes of a bright red color, soon followed by a marked œdema of these parts,⁶ and occasionally there is pharyngitis, which is sometimes sufficiently severe to cause difficulty in swallowing. This condition, La Roche states,⁷ is most common in the congestive variety of the disease. Hemorrhages from the fauces, pharynx, and œsophagus not infrequently occur in the later stages, and sometimes at an early period. According to La Roche,⁸ where such hemorrhage is met with early it is of but little significance, but if it takes place at an advanced stage and is accompanied, as is generally the case, with a sense of ardor and constriction in the part affected and extending down towards the stomach, this symptom acquires great importance, and must be viewed as indicative of imminent danger. It is preceded and announced, in most cases, by pain and heat in the fauces and about the neck, and on examination the mucous membrane of the throat will often be found to be red and engorged.

¹ Murchison, *op. cit.*, p. 382.

² Pepper's *System of Medicine*, vol. i. p. 403.

³ *Ibid.*, p. 814.

⁴ Keating's *Cyclopædia of Diseases of Children*, vol. i. p. 532.

⁵ Roberts, *op. cit.*, p. 240.

⁶ Haenisch, *Ziemssen's Cyclopædia*, vol. i. p. 497.

⁷ La Roche on *Yellow Fever*, Philadelphia, 1855, vol. i. p. 131.

⁸ *Op. cit.*, p. 141.

MALARIAL FEVER.

The whole of the respiratory tract, from the mucous membrane of the nose to the alveoli of the lung, says Forchheimer,¹ may suffer from malarial poison. As a consequence of the infection, pharyngitis or enlargement of the tonsils may occur independently, or in connection with intermittent attacks of coryza, and the entire mucous membrane of the pharynx is very commonly involved. In certain instances a paralysis of the organs of deglutition has been noted.² In the aggravated form of malarial disease known as hæmaturic bilious remittent fever, burning pain in the pharynx is a frequent symptom. In 1888 Chassaignac³ called attention to a variety of acute tonsillitis in the causation of which he believes malaria is a prominent factor, since it is characterized by a periodic exacerbation after painful symptoms and is not benefited by the usual methods of treatment, while it yields readily to quinine or other alkaloids of cinchona. Similar observations have been made by others, and Beverley Robinson⁴ expresses the opinion that a malarial tendency underlies many of our ordinary catarrhal colds. In certain instances, he states, the malarial hæmatozoid has been found in the blood, and these cases are promptly cured by quinine, while local treatment is of but little service.

In the larynx in malarial poisoning there are sometimes produced a series of symptoms resembling those of croup. Briand⁵ has described this affection as consisting of attacks of high fever coming on at more or less regular intervals, combined with intense redness of the pharynx, hoarseness, stridor, and dyspnoea. These paroxysms may last for hours, and the whole affection resembles croup. Although he calls attention to the difficulty in diagnosis, Forchheimer⁶ thinks there ought to be no such difficulty if the time of the attack, enlargement of the spleen, periodicity, and intervals of almost perfect rest be taken into consideration. Briand says that the prognosis is very much better than in croup, because the disease can be readily treated. Bierbaum has reported a case of malarial fever in which dyspnoea, cough, and aphonia resulted from neuralgia of the laryngeal branches of the pneumogastric nerve.⁷

TYPHO-MALARIAL FEVER.

In so-called typho-malarial fever, which he understands to be an expression of the malarial poison in which intestinal and adynamic symptoms are prominent, Squire states⁸ that tonsillitis may occur as a prominent sign.

¹ Keating's *Cyclopædia of Diseases of Children*, vol. i. p. 838.

² Hertz, *Ziemssen's Cyclopædia*, vol. ii. p. 601.

³ *New Orleans Medical and Surgical Journal*, October, 1888.

⁴ Report of the Thirteenth Annual Meeting of the American Laryngological Association, *Medical Record*, New York, October 3, 1891.

⁵ *Gazette des Hôpitaux*, 1883, No. 40.

⁶ *Op. cit.*, p. 839.

⁷ *Deutsche Klinik*, 1862.

⁸ *Lancet*, *Annual of the Universal Medical Sciences*, 1888, vol. i. p. 275.

DENGUE.

In many cases of dengue the mucous membrane of the pharynx is more or less congested, and in the severer ones it is frequently decidedly inflamed. In the reports by various observers from which Aitken derives his description of the disease it is stated that in most instances, though not in all, as in the epidemic at Suzuratte, the throat and fauces were so affected as to make deglutition painful.¹ In an account of an outbreak in Egypt in 1887 and 1888 Dr. F. M. Sandwith says,² "The throat during this epidemic was complained of by less than one-fourth of the patients, and when examined was found to be red and erythematous, without great swelling or ulceration of the tonsils. Many other patients' throats were found to be red and angry-looking, though they suffered no inconvenience from them. In two cases the throat-symptoms seemed more important to the patient than the pains or rash; but, as a rule, the throat was casually mentioned upon the first day and remained only a little sore for three or four days. I saw no enlargement of the submaxillary glands or indurated swelling of the neck and connective tissue such as occurs in some cases of scarlatina." By Flint and Welch it is stated,³ however, that the pharyngitis met with is sometimes associated with enlarged cervical glands, and according to Chrystie also the neighboring lymphatic glands are often the seat of transient swelling in severe cases where the throat is inflamed.⁴ Aitken, furthermore, states⁵ that sometimes the salivary glands are much swollen (the parotid as early as the fourth day), and that the discharge of saliva in some instances amounted to ptialism.

INFLUENZA.

The pharyngeal and laryngeal lesions of influenza are essentially those of catarrhal pharyngitis and laryngitis of unusually severe type; but certain peculiarities have been noted by various observers. As the disease has appeared in recent years, catarrh of the upper air-passages occurs, according to Cohen,⁶ in about one-fourth of all cases. Some time ago a punctiform redness of the mucous membrane of the palate, something like that seen in the early stage of measles, was described by Tigri, and considered by him to be pathognomonic;⁷ but his observations do not seem to have been confirmed. Cohen⁸ states that he has seen nearly all the common inflammatory states usually met with, but that the most characteristic condition is that

¹ Reynolds's System of Medicine, vol. i. p. 180.

² Lancet, July, 1888.

³ Op. cit., p. 1073.

⁴ Ziemssen's Cyclopædia, vol. ii. p. 512.

⁵ Op. cit.

⁶ Report of the Thirteenth Annual Meeting of the American Laryngological Association, Medical Record, New York, October 3, 1891.

⁷ Reynolds's System of Medicine, vol. i. p. 40.

⁸ Op. cit.

of lymphoid œdema; and he thinks that there is undoubtedly a vaso-motor paresis of both the blood-vessels and lymph-vessels. P. Koch¹ found that the reddened, swollen uvula, often displaced by a unilateral œdema, sometimes simulated a symptom of albuminuria. He describes the mucous membrane of the fauces and pharynx as of a violet-red color, very œdematous, and of a general appearance closely resembling that met with in idiopathic erysipelas of this region, and states that Bouchard and Weichselbaum found in the naso-pharyngeal secretions the streptococcus and pneumococcus characteristic of erysipelas and suppurative pneumonia. Asch² has found tonsillitis the most common local feature, and Vilecq³ met with a severe phlegmon of the pharynx which was accompanied by enormous œdema of the throat, neck, and face, which resulted from a phlegmonous tonsillitis. Ulcerations of the pharynx and croupous deposits on the tonsils and the posterior pharyngeal wall have also been sometimes observed.⁴ P. Koch states⁵ that paralysis of the first period from inflammation is very rare, but paralysis affecting the larynx and the soft palate are met with later on; and Cohen says that he has seen paralysis of the throat-muscles follow, as in diphtheria. In some cases the catarrhal inflammation is confined to the tonsils and pharynx, the lower air-passages escaping. Not infrequently, however, there occurs more or less violent inflammation of the middle ear, from extension of the inflammatory process through the Eustachian tube.

In a considerable proportion of cases the larynx is attacked as well as the pharynx, while occasionally the latter may remain unaffected. Fraenkel states⁶ that out of forty-five cases of influenza at the Berlin Polyclinic thirty-three of the patients suffered from laryngitis. He considers intermittent aphonia to be the prominent symptom of the laryngitis of influenza. The laryngoscopic examination, he says, shows the mucous membrane reddened and swollen, sometimes as far as the subglottic region. Three pairs of folds are then seen superposed; the constrictors are paretic or paralyzed. His description of the vocal cords agrees with that of Lublinski,⁷ who states that at the outset they are shining, swollen, and reddened, while later white or grayish spots appear on them which resemble superficial necrosis. Among Lublinski's cases there were two of laryngitis subglottica. Le Noir⁸ describes a special form of laryngitis characterized by superficial ulcerations of the two vocal cords, and states that similar ulcerations were observed by Cartaz in one instance in the arytenoidean space. Many of the

¹ *Annales des Maladies de l'Oreille et du Larynx*, March, 1890.

² Report of the Thirteenth Annual Meeting of the American Laryngological Association, *Medical Record*, New York, October 3, 1891.

³ *L'Union Médicale du Nord-Est*, No. 6, 1890.

⁴ Lublinski, *Deutsche Medicinische Zeitschrift*, June 23, 1890.

⁵ *Op. cit.*

⁶ *Deutsche Medicinische Wochenschrift*, No. 28, 1890.

⁷ *Op. cit.*

⁸ *Annales des Maladies de l'Oreille et du Larynx*, March, 1890.

cases of laryngitis seen by him at the Hôpital Lariboisière were, however, not at all severe in character. Hemorrhage and abscess of the larynx are stated by Cohen to be common, and in three cases of the former given by Marano¹ it is worthy of note that with the hemorrhage there was present dysphagia, on account of the swelling of the mucous membrane of the arytenoid cartilages. Localized or more or less general œdema is not infrequently met with in the larynx as well as in the pharynx, and occasionally its acute occurrence may necessitate prompt surgical interference. Cohen mentions death from spasm as resulting from œdema of the glottis. Œdema of the larynx may also occur as a sequel of influenza, as in a case reported by Wolfenden,² in which a pale, bladder-like projection of the right ary-epiglottic fold was followed, three days after, by a bluish-red œdematous swelling of the left corresponding fold. The treatment consisted of free scarification, with pinol inhalations, and complete recovery followed in a few days. Subacute or chronic laryngitis may be left after influenza, and among the sequelæ observed by Lublinski³ were laryngitis hæmorrhagica in four cases and laryngitis subglottica in two.

The local treatment of the pharyngitis and laryngitis does not differ from that appropriate to ordinary inflammatory conditions of severe grade in the throat. For the laryngeal trouble sprays of carbolic and boric acids, cocaine, and resorcin have been found among the most useful therapeutic means.

A curious and interesting fact in connection with influenza is the apparently curative effect which it has in certain instances upon pre-existing pathological conditions. Two very remarkable cases of this kind are related by Cohen.⁴ In the first, a man aged eighty had an epithelioma of the palate which had been treated with partial success. He suffered severely from influenza, and after he had recovered from the latter the epithelioma entirely disappeared. In the second, a woman of fifty, who was affected with tuberculosis of both the larynx and the lungs, had an attack of influenza, and is now a well individual.

ACUTE RHEUMATISM.

Very frequently, especially among children, an attack of articular rheumatism is preceded by the occurrence of acute pharyngitis and tonsillitis, which usually pass off in the course of a few days, but in exceptional instances may continue during the articular trouble. In other cases acute rheumatism is attended with a similar affection of the throat which does not develop until later on in the attack. The statistics of the Collective

¹ *Archiv. Ital. di Laringologia*, May 2, 1890; *Journal of Laryngology and Rhinology*, August, 1890, p. 346.

² *British Medical Journal*, March 8, 1891.

³ *Deutsche Medicinische Zeitschrift*, June 23, 1890.

⁴ Report of the Thirteenth Annual Meeting of the American Laryngological Association, *Medical Record*, New York, October 3, 1891.

Investigation Committee of the British Medical Association¹ show that tonsillitis occurred as an antecedent to acute articular rheumatism in no less than twenty-four and twelve-hundredths per cent. of cases, with ten per cent. of sore throat of uncertain character. Cheadle,² in commenting on this large percentage, remarks that its full significance is realized only when we consider that the throat-affection occurs also as a later as well as an initial affection, although not so frequently, and that it occurs apart from articular symptoms in rheumatic subjects. Referring to one case mentioned in the report, in which repeated attacks of tonsillitis followed an attack of acute articular rheumatism, which never recurred, but which was succeeded by chorea and purpuric erythema, he says that there could be no hesitation in accepting tonsillitis as a genuine member of the rheumatic series. The pharyngitis and tonsillitis which occur in connection with acute rheumatism are not characterized by any distinctive peculiarities and seldom cause supuration or ulceration; though occasionally the cervical glands become swollen and painful. Sometimes, however, the angina is of a severe grade, and in one fatal rheumatic case that occurred at Guy's Hospital the tonsils were suppurating.³ When it precedes the articular attack it is usually accompanied by considerable fever, the temperature sometimes rising to 103°, but the throat-affection often terminates before the inflammatory process becomes established in the joints. It is apt to be ushered in by sudden and severe pain in the throat, and dysphagia is often a prominent symptom.

Acute laryngeal rheumatism has been fully recognized only within the last few years, the first important observation on the subject having been made by Desbrousses⁴ in 1861. It was of special value as it was confirmed by an autopsy. During life the patient suffered from pain in the larynx accompanied by aphonia, and after death, which was due to the results of perichondritis, it was found that the arytenoid cartilages were laid bare, but without necrosis, while in the left crico-arytenoid articulation there was a serous, reddish liquid. The existence of acute rheumatic laryngeal arthritis was placed beyond doubt by this case. Since then, cases have been reported by Libermann,⁵ Fauvel,⁶ Coupard,⁶ Joal,⁶ Archambault,⁷ Simpson,⁸ and others. In Libermann's case, which was of gonorrhœal origin, laryn-

¹ Collective Investigation Record, vol. iv., 1888, p. 71.

² Keating's Cyclopædia of Diseases of Children, vol. i. p. 801.

³ Fagge, *op. cit.*, vol. ii. p. 533.

⁴ Considerations upon some Points of Acute Articular Rheumatism: Inaugural thesis, by E. Emery Desbrousses, Strasbourg, 1861.

⁵ Gazette des Hôpitaux, 1873, p. 1082; also L'Union Médicale, 1873, pp. 136 and 997.

⁶ A. Laranza, Revue Générale de Clinique et de Thérapeutique, June 21, 1888.

⁷ Inaugural Thesis on the Acute Laryngeal Manifestations of Rheumatism, Paris, 1886.

⁸ Report of Section on Laryngology and Otology of the American Medical Association, Journal of Laryngology and Rhinology, October, 1889.

goscopic examination revealed marked tumefaction of the left arytenoid cartilage about the articular portion, which presented a very considerable globular swelling, and this gave a sensation resembling fluctuation when a laryngeal sound was used. The mucous membrane covering the arytenoid was red, but the redness did not pass beyond the cartilage. The left vocal cord was narrower than the right, and did not reach the median line. In Simpson's case, which was also of gonorrhœal origin, there was a painful swelling of the lower external portion of the larynx, and internally both arytenoids were swollen and red, the right much in excess, and somewhat œdematous. All the interior of the larynx was more or less hyperæmic, and the right vocal cord was of a deep purple color, considerably swollen, and immobile on phonation. Libermann attaches a certain importance to the exacerbation of pain by pressure in such cases, which he thinks may furnish a differential diagnostic sign between articular and muscular rheumatism of the larynx, in which latter he states that the pain is less considerable and is never augmented by pressure on the laryngeal walls. Laranza, however, has not discovered a single reported clinical example of rheumatism of the laryngeal muscles.¹

Treatment.—In the treatment the principal dependence is to be placed on internal medication adapted to the rheumatic condition, and this should be commenced as soon as there is any reason to suspect that the throat-trouble is of rheumatic origin. Sedative applications may be made, however, when necessary to relieve pain, and in rheumatic laryngitis a blister used externally may prove a valuable accessory to the treatment, as in Simpson's case.

ACUTE GOUT.

There is very little to be found in medical literature in regard to acute gout in the throat, but that anginal affections may be due to this cause seems to be proved by the fact that in occasional instances inflammatory conditions in the larynx or pharynx have been known to disappear simultaneously with the supervention of acute gout in some other part of the body. Thus, a case is related by Mackenzie² of acute œdema of the uvula disappearing upon sudden development of gouty inflammation of the great toe. The patient complained of sore throat and was much distressed, and on examining the throat Mackenzie found the uvula inflamed and swollen, so that it had very much the shape of a muscatel grape, and he observed that it was redder than is usually the case in œdema. The next day, however, the swelling of the uvula had entirely disappeared, and the patient was suffering from typical podagra.

¹ Annual of the Universal Medical Sciences, 1889, vol. iv. G 3.

² Journal of Laryngology and Rhinology, August, 1889.

ACUTE GLANDERS.

In this affection the mucous membrane of the pharynx, and even of the larynx in many cases, is the seat of lesions which pathologically are essentially the same as in the horse. There are at first hard yellow nodules, which become pustular and bathed in purulent fluid. These are made up of cells, the result of proliferation, which soon degenerate, the nodules rapidly becoming soft and breaking down, forming abscesses and ulcers.¹ The latter are often of considerable size and are unhealthy and chancreous-looking. The pharynx and palate, according to Fagge,² may become covered with a kind of false membrane. In the human subject a discharge from the nose is by no means always present, Hauff stating that it was observed in only thirty out of seventy cases;³ but when it does occur it greatly aggravates the condition of the respiratory passages. It is of a purulent, viscid, extremely fetid, and often sanious character, and it clogs the nostrils and obstructs breathing, while it also escapes through the posterior nares, causing much distress and irritation in the throat.⁴ In many cases glandular enlargements appear in the parotid and submaxillary regions.

If the ulcers extend into the larynx they are apt to produce hoarseness, and an œdematous laryngitis may set in which will require surgical interference.

Treatment.—Acute glanders is exceedingly likely to prove fatal, but all that is possible in the way of cleanliness and disinfection should be done to improve the local condition. In most cases the same plan of management that is called for in bad cases of scarlatinous or variolous sore throat will be appropriate.

¹ Roberts, *op. cit.*, p. 229.

² *Op. cit.*, p. 316.

³ Fagge, *op. cit.*

⁴ Roberts, *op. cit.*, p. 230.

NEUROSES OF THE LARYNX AND OF THE PHARYNX, AND DYSPHAGIA.

BY W. PEYRE PORCHER, M.D.,

Lecturer on Laryngology and Rhinology and on Materia Medica and Therapeutics in the Charleston Medical School; One of the visiting Laryngologists to the City Hospital, etc., Charleston, South Carolina.

PART I.

NEUROSES OF THE LARYNX.

THE neuroses of the larynx may be divided into two classes,—viz., neuroses of sensation, or *æsthioneuroses*, and neuroses of motion, or *kinesioneuroses*. They may be due to disease or injury of the brain, the spinal column, or the local nerves, and are then known as organic neuroses. When not due to these causes they are known as functional neuroses.

NEUROSES OF SENSATION.

Neuroses of sensation, or *æsthioneuroses*, may be considered under various subdivisions, the modern neurological nomenclature of which would be about as follows (J. Solis Cohen):

1. Neuroses of tactile sensibility, comprising: (*a*) Augmented sensitiveness to touch, hyperæsthesia. (*b*) Perverted sensitiveness, paræsthesia, including abnormal sensations of numbness, discomfort, tickling, itching, burning, tingling, pinching, of constriction, and of the presence of a foreign substance. (*c*) Obtunded sensitiveness, hypæsthesia (Eulenburg). (*d*) Abolished sensitiveness, anæsthesia, including numbness produced by applications with ice or with drugs, such as preparations of aconite, carbolic acid, menthol, cocaine, and the like.

2. Neuroses of dolorous or pathic (Ross) sensibility, comprising: (*a*) Continuous hypersensation, pain, algesia. (*b*) Augmented sensations in painful conditions, hyperalgesia or hyperalgia, including painful sensations caused by the dread of an anticipated touch. (*c*) Perverted sensation, paralgesia, under which might be mentioned a feeling of constriction or dryness of the parts. (*d*) Diminished sensation, hypalgesia or hypalgia (Eulenburg), including numbness. (*e*) Abolished sensation, analgesia. (*f*) Paroxysmal painful sensations along the course of a sensory nerve, neuralgia.

3. Neuroses of thermal sensibility, comprising: (a) Augmented sensitiveness to heat or to cold. (b) Perverted sensitiveness, sensations of heat, of burning, scalding, melting, of intense cold. (c) Diminished, or (d) abolished sensitiveness.

4. Neuroses of muscular sensibility, comprising augmented sense of weight in the parts, or pressure upon them, or of mechanical restriction in moving them, altogether independent of any condition of motor paralysis, as when distinct excessive muscular effort is required for phonation in fatigue from over-use or prolonged use of the voice.¹

HYPERÆSTHESIA.

Etiology.—Augmented tactile sensitiveness or supersensitiveness of the laryngeal mucous membrane is present in ulcerative or inflammatory disorders, or, where no local lesion is evident, it may be symptomatic of hysteria. It also occurs as a reflex neurosis. In some instances the pain is so great as to deter the patient from all attempts at using the voice. It constitutes one of the most prominent symptoms of laryngeal phthisis, and is a frequent accompaniment of spasm of the larynx.

A rheumatic or gouty diathesis, or a highly neurotic temperament, is the chief indirect cause; inflammations, excoriations, small neoplasms, fissures at the base of the tongue or upon the pharyngeal wall, tonsils, or palatine folds, are the most frequent direct causes.

Symptomatology.—In hyperæsthesia of the mucous membrane of the larynx, the parts are abnormally sensitive to the least irritation, giving rise, in many cases, to an irritating cough, and sometimes to attacks of spasm, gagging, and even convulsions. True neuralgia of the throat is a rare affection (Mackenzie), but rheumatic or gouty throats, as they have been termed, are by no means uncommon.

Treatment.—The treatment should be both local and constitutional. The constitutional measures vary in accordance with the origin of the trouble,—viz., whether the patient be highly nervous, hysterical, rheumatic, or gouty. If nervous and hysterical, sedatives, such as the bromides, chloral, hyoscyamus, musk, asafoetida, valerian, etc., must be used in combination with nerve and blood tonics, as arsenic, iron, quinine, strychnine, etc. Where there is a rheumatic or gouty diathesis present, anti-rheumatics, colchicum, guaiac, salol, or the other salicylates, etc., are indicated. The liver, the kidneys, and the digestive and depurative functions generally should be carefully looked after, and all hyperæmic tendencies should be

¹ As the most salient features of these neuroses have already been fully described in the text-books, and as the space allotted to this subject is so limited, it will be my endeavor in this paper to describe them in the briefest possible manner.

I must express my indebtedness here to Drs. J. Solis Cohen, J. O. Roe, Max Thorner, F. H. Bosworth, F. I. Knight, G. M. Lefferts, E. F. Ingals, G. W. Major, L. Putzel, Carl Seiler, Edgar Holden, C. H. Leonard, Lennox Browne, and Sir Morell Mackenzie, from whose articles on this subject I have made liberal extracts in notes and illustrations.

especially combated. Change of air, sea-bathing, or a course of hydropathic treatment will often effect a cure of both the local and the constitutional condition.

The topical treatment consists in the persistent application of sedatives, repeated once or twice a day, and continued until the pain is controlled. Morphine, bismuth, aconite in glycerin or water, iodoform in ether or chloroform, cocaine, menthol, thymol, solutions of opium in spray, the bromides, chloral, camphor, peppermint water, iodol, and simple sprays of ice-water have all been used, with varying success. Schnitzler, of Vienna, advises a solution of morphine and chloroform, which is very serviceable.

In obstinate cases, resort must be had to the more powerful escharotics. Strong solutions of argentic nitrate or the mitigated stick, or applications of the galvano-cautery itself, may be used. When there are traumatic or plastic lesions producing hyperæsthesia, they will require to be combated, destroyed, or removed according to special indications.

ANÆSTHESIA.

The term "laryngeal anæsthesia" is used to indicate a considerable loss of sensation in the larynx, and may or may not be associated with motor paralysis. It may be confined to the epiglottis, to the supra-glottic portion of the larynx, or involve the entire larynx, pharynx, and trachea. It is generally due to changes in the peripheral nerve-fibres, as in diphtheria, syphilis, and long standing inflammations. It may also be a symptom of a pathological condition of the nerve-centres.

Symptomatology.—The chief symptom is an absence of cough and reflex irritation on the accidental introduction of food or foreign substances into the larynx.

Diagnosis.—Probing and electrical stimulus are the surest modes of diagnosis. The most sensitive portion is usually the mucous membrane over the outer arytenoid fold. The best method of determining apparent anæsthesia is the comparison of the sensitiveness of structures adjoining and at a distance.

Prognosis.—The prognosis is very grave when the affection results from a bulbar or other central lesion. It is also dangerous when associated with catarrhal inflammation, since the secretion may accumulate in large quantities in dangerous places, there being no reflex cough to cause its removal. In diphtheria and syphilis the prognosis is good, provided prompt and active steps are taken to avoid untoward accidents.

Pathology.—Loss of function of the superior laryngeal nerve or of certain fibres of the pneumogastric must be the cause of laryngeal anæsthesia. The pathology of paralysis due to bulbar disease or to diphtheria can be found in any of the text-books on general medicine.

Treatment.—The treatment varies, of course, with the nature and cause of the disease. Phosphorus, zinc, or strychnine should be given internally. Locally, electricity, in the form either of the constant or the interrupted

current, has been used with striking success. The current should be strong enough to produce distinct sensation, but not pain. The laryngeal electrode should be introduced into the larynx six or eight times at a sitting, the treatment being carried out daily. Feeding by the œsophageal tube must be resorted to when there is danger of the passage of food into the larynx. Especial care must be taken, also, that the instrument is not inserted into the larynx instead of the œsophagus, as is likely to occur when there is general anaesthesia. Constitutional syphilis, bulbar disease, etc., must be met by remedies appropriate for these conditions.

PARÆSTHESIA.

Paræsthesia denotes perverted or abnormal sensations in the larynx. They may be diffused or localized, but are not necessarily accompanied by pain. It is most often found in hysterical females, and simulates the presence of a hair or other foreign body, causing an itching, sticking, or burning sensation. These sensations are sometimes confined to the pharynx, but most frequently they are referred to the larynx or tracheal region. They are often the source of great mental distress to the patient, from the fear that some incurable disease is present, and, as the sensations are provoked or increased by phonation or deglutition, the patient will as far as possible refrain from the latter, and thereby seriously jeopardize life.

Under the head of "Imaginary Foreign Bodies in the Throat," Dr. Max Thorner¹ makes the following classification, with some comments which are so excellent that I will quote them here :

"Foreign bodies which are alleged to be located somewhere in the air-passages or œsophagus, without being there, may be conveniently divided into three different classes :

"1. Cases where a foreign body finds its way into the air-passages without remaining there, but leaving to the patient the sensation of its being located somewhere in that region.

"2. Cases where no foreign body ever got into the throat, but where some pathological condition of the throat imposes upon the patient the sensation of a foreign substance.

"3. Cases where neither of these two previous causes can be made responsible for the presumption, where no pathological change can be detected in the region under consideration, and where the sensations of the patient are either reflex in character, produced by some more or less remote ailment, as, for instance, in cases of indigestion, or where the trouble is of purely neurotic character.

"In regard to the first class, we must of necessity first establish the fact that an extraneous substance really found its way into the throat, and, if so, we must try to ascertain where it is. I will remark here that in using the word throat my intention is to speak of the whole upper air-passages

¹ New York Medical Journal, January 25, 1890.

and the œsophagus. A foreign body in the larynx or trachea will in most cases make itself known by signs not to be mistaken, such as difficulty in breathing, coughing, and eventually hoarseness or aphonia. Sometimes auscultation above the trachea will reveal the presence of some foreign substance located there. If these symptoms are missing, inspection, laryngoscopic and rhinoscopic, and palpation—the latter, especially for the post-nasal space and for the œsophagus, with the œsophageal bougie—do much toward ascertaining whether the extraneous substance has not yet been dislodged.

“If all these examinations, carefully and repeatedly executed, are negative, we may reasonably conclude that the foreign body is no longer in the throat. I am fully aware that occasionally such bodies resist all means of detection; but this is undoubtedly the exception, and in such cases we must simply wait for further developments. In such cases either they will subsequently be dislodged and cease to be troublesome to the patient, or they will be the cause of other disturbances, and thus indicate their presence and location.

“The second class of patients comprises such patients as have some more or less decided pathological condition in the throat which impresses them with the sensation of a foreign body. Such conditions are hypertrophied tonsils, accumulated cheesy matter or concretions in the crypts of the tonsils, enlarged uvula, glandular pharyngitis, enlarged circumvallate papillæ or a hypertrophic condition of the lymphoid nodules (the so-called lingual tonsil), or varicose veins at the back of the tongue, or varicosities in the uvula or pharyngeal mucosa. Furthermore, neoplasms in the throat may cause the sensation of foreign bodies, such as papillomata or adenoid vegetations at the vault of the pharynx. It stands to reason that we have much easier work than in the first class of cases, when we discover any of these conditions in cases where a supposed foreign body is the cause of the complaint. Our treatment will have to consist in removing the cause of the disturbance by any of the methods adapted to the purpose, and we shall not fail to obtain a cure of the morbid sensations.

“The most difficult group of cases as to treatment, and frequently the most unsatisfactory ones as regards a cure, is the third class of my division. I refer to those where either a remote cause is responsible for the sensation of a foreign body, or where nothing can be found, where the throat is in a normal condition, and where we must consider the affection as a pure neurosis, a paræsthesia of the throat. It is true, however, as Mr. Lennox Browne has shown, that a great number of these neuroses of the throat, among them the time-honored globus hystericus, do in reality belong to the former class of affections; that, upon careful examination in cases of this kind, we may not infrequently find any or several of the conditions enumerated above, the removal of which will cause a speedy cure of the supposed neurosis. Yet there still remains a number of cases where this does not apply, where the trouble is, so far as we know at the present

time, of a purely neurotic character, and these cases are more or less unsatisfactory.

"In most cases where a foreign body has entered the throat, but has been removed, we may convince the patient that such is the case. When, however, we cannot disabuse his mind of his fears, when we see him becoming a victim to his morbid and vivid imagination, we may, nay, we even must, use some innocent deception, if by so doing we can cure him of his presumption and restore his balance of mind."

Treatment.—The treatment consists in allaying all inflammations by suitable remedies and the administration of the bromides and other soothing anodynes in combination with zinc, arsenic, and quinine. The moral effect of assuring the patient in the most positive way that the cause of the irritation can be removed is a very important factor in the treatment. The sensation of the presence of a foreign body in the throat will often remain for some time after its removal; and it will be almost if not quite impossible to convince the patient of its entire removal, until the inflammation resulting from its presence has disappeared. If the lingual, faucial, or pharyngeal tonsils are hypertrophied, they must be treated, and if there is any follicular pharyngitis present, applications of the galvano-caustic needle will prove of great benefit. All constitutional cachexia, malaria, rheumatism, syphilis, etc., will require appropriate remedies.

NEUROSES OF MOTION.

The neuroses of motion, or kinesi-neuroses of the larynx, may be subdivided into *spasm of the larynx*, or *hyperkinesis*, and *paralysis of the larynx*, or *akinesis*.

The most common symptoms of hyperkinesis or spasm of the larynx vary so much when seen in children and in adults that it has been found necessary to consider this also under two headings,—viz., *spasm of the glottis in children*, or *laryngismus stridulus*, and *spasm of the glottis in adults*.

SPASM OF THE GLOTTIS IN CHILDREN.

Etiology.—Age is considered to be the principal predisposing cause of spasm of the glottis in children, on account of the rapid developmental changes which occur in infancy, and the yielding character of the laryngeal tissue at that time. A rachitic diathesis is the next most common cause of this condition, and hence heredity forms a prominent factor in the causation. The exciting cause may be a direct local irritation of the laryngeal mucous membrane, or the attack may be the result of reflex action. A fit of crying or of coughing, or the accidental introduction of a drop of milk into the larynx while suckling, may bring on an attack. Indigestible food, difficult dentition, the presence of intestinal parasites, or the pressure of enlarged bronchial glands on the laryngeal nerves may be mentioned among the reflex causes. As regards sex, it is a noticeable fact that the spasm occurs much more frequently in males than in females.

Symptomatology.—Laryngismus stridulus or spasmodic croup in infants usually occurs in children with impaired nutrition or rickets, and during the first year of life, although they may be one or two years older. It generally begins with an alarming arrest of respiration, and may either awake the child from sleep or come on while he is awake. It is usually characterized by a spasmodic action of the abductors of the vocal cords and spasm of the intercostal and diaphragmatic muscles. The most marked symptom is a succession of short, stridulous inspirations, which gradually become more prolonged and generally end in a fit of crying; but the attack may prove rapidly fatal by apnoea. The first attack of croup usually comes on at night; the child may have been perfectly well all day, or perhaps fretful and peevish for a day or two before, may have suffered from loss of appetite, and perhaps a slight catch has been noticed in its respiration. An attack may also come on while the child is at the breast. The child will suddenly stop sucking, its eyeballs will be turned up, then it will give a loud crowing inspiration and return to the breast. In some cases there will be a spasm, which may not relax until life is extinct, the child not making a sound; but these cases are fortunately rare. The common type is where the attack comes on at night and there is no return of it upon the following day, but there may be an immediate return of the attacks or a frequent succession of them, or there may be a complete absence of any attacks during the day and a periodical return at night. There is generally a complete absence of pyrexia in these cases, but the sweating of the head so characteristic of rachitis is almost universally present.

Diagnosis.—The absence of fever and the distressing cough, with impairment of voice, will differentiate this condition from sub-glottic laryngitis, with which it is most likely to be confused. In addition, in sub-glottic laryngitis the dyspnoea is generally only inspiratory, while in true spasm it is both inspiratory and expiratory. The presence of a laryngeal neoplasm would give rise to progressive attacks of dyspnoea, but spasm is a rare accompaniment, and the growth may be detected by the laryngeal mirror.

Paralysis of the abductors, which is the next most likely affection for which it may be mistaken, is an extremely rare disease in young children, and there is almost always a small opening between the vocal cords, whereas in spasm of the glottis the aperture is tightly closed and no air can pass through until the spasm is relaxed. This, however, is not an invariable rule.

Pathology.—The current of opinion in modern thought seems to tend to the belief that the disease is due to molecular changes in the nerve-centres, as a result of malnutrition, affecting all the structures of the body and acting upon the larynx through the pneumogastric nerves. Some cases are due to irritation of the trifacial nerve in dentition, or to enlarged scrofulous glands in the tracheo-bronchial tract, but the majority are due to cranio-tabes in rachitis,—a condition in which hyperæmia of the meninges or of the encephalon is readily produced by fits of crying, laughing, fright, etc.

Prognosis.—The prognosis must be a guarded one, for the spasm may end fatally. Some authors in America have placed the estimate of mortality as high as one-third of all cases. The older the child, the better the nutrition and surroundings, and the longer the intervals between the paroxysms, the better will be the prognosis.

Treatment.—The treatment should be directed first to relieve the spasm, and next to remedy the general condition which produces this symptom. The child should be placed in the semi-recumbent position, its head bent back and its tongue drawn out so as to facilitate respiration. Cold water should be dashed on the face, and cold compresses applied to the head and neck, and the finger may be passed into the fauces so as to titillate the back of the throat and provoke vomiting, or to liberate an incarcerated epiglottis. Immediately upon the relaxation of the spasm, efforts should be made to remove the cause, whether it be in the mouth, stomach, intestines, vagina, or prepuce. The administration of a relaxing emetic, as hive syrup or syrup of ipecac, will often prevent an immediate return of the spasm, and this should be followed by some anodyne or antispasmodic, as the bromides, musk, chloral, asafœtida, etc. Antipyrin has been used with advantage in a number of cases, as have also curare and physostigma, on account of their well-known relaxing and sedative effect. The first may be given in fiftieth-of-a-grain doses, and the latter in half-drop doses of the fluid extract. If the spasm is obstinate, the inhalation of a little chloroform will often give immediate relief, but anæsthetics should always be used with caution. When chloroform does not relieve the spasm, resort must be had to hypodermic or rectal medication. Apomorphine, gr. $\frac{1}{30}$ to $\frac{1}{16}$, or atropine, gr. $\frac{1}{160}$, and morphine, gr. $\frac{1}{16}$, may be given hypodermatically. The attack having passed off, a brisk purgative of calomel or of gray powder, followed by some saline cathartic, should be administered to carry off any undigested food or other irritant in the intestinal tract.

When the attacks recur at night, five grains of chloral hydrate should be given before bedtime, or the same quantity of bromide of potassium may be given three times a day as a general sedative. The greatest attention should be paid to the quantity and quality of the food. As the simple act of taking the breast will sometimes precipitate an attack, the child should be fed with a spoon. If the patient has previously been bottle-fed, a wet-nurse should be at once obtained, or cow's milk or ass's milk diluted with water may be given if a wet-nurse cannot be obtained. The possibility of dentition being the cause should be remembered, and the gums should be well incised when that is found to be the cause. The general health should be kept up by means of cod-liver oil, the hypophosphites, and syrup of the iodide of iron. The sleeping-apartments should be well aired, and the child should be carried out into the open air whenever possible.

SPASM OF THE LARYNX IN ADULTS.

Under the head of spasm of the larynx in adults may also be considered chorea laryngis, and reflex epileptiform neuroses of the larynx, or laryngeal vertigo.

Laryngeal spasm is a spasmodic contraction of all the muscles of the larynx, both dilators and constrictors, but the constrictors are the most powerfully affected, and hence the condition may be mistaken for paralysis of the abductors. It is also often associated with abductor paralysis. The spasm may be tonic or clonic, and may occur after respiratory or phonatory efforts. The respiratory spasm may occur in the inspiratory or the expiratory effort, as frequently happens upon the introduction of caustic substances into the larynx: the inspiratory effort is then very severe, while the expiratory is free. These cases, however, are not strictly neuroses, being dependent upon a local irritating cause.

Etiology.—Functional spasm may be due to molecular nerve-changes without structural lesion. Organic spasm will most frequently be caused by pressure upon, or direct injury to, the nerve trunks or centres. Reflex spasm may be caused by irritation of the nasal or pharyngeal mucous membrane by foreign bodies or neoplasms, or by reflex irritation from more distant organs, as the ovaries, alimentary canal, etc. It may be produced by the presence of foreign bodies or tumors in the larynx, traumatism, syphilis, and tubercular disease, diphtheria, hydrophobia, tetanus, ulcers, etc. It constitutes one of the prominent symptoms or crises in locomotor ataxia, and is thought to be due to the invasion of the respiratory centre in the medulla by that disease. By far the most common cause of laryngeal spasm, however, is reflex excitation from some portion of the air-tract dependent upon a general nervous reflex excitability. It is much more frequently seen in women than in men.

Symptomatology.—The chief symptom of laryngeal spasm is a violent paroxysm of dyspnoea, which occurs much more frequently at night than during the day. The patient becomes rapidly cyanotic, and the attack lasts about fifteen seconds, gradually passing off. The violence and frequency of the attacks depend on the exciting cause, but there is no regular periodicity about their return.

Diagnosis.—The diagnosis is made by the clinical history, the dyspnoea and sudden stridor, and by the aid of the laryngeal mirror. The cords are seen to be closely approximated, and the arytenoid cartilages are drawn backward, a point which serves to distinguish it from bilateral paralysis of the abductors. The cause of the spasm, if possible, should be ascertained, whether it be due to disease in the nose or in the naso-pharynx, or to a lesion of the brain or spinal column, or to reflex excitation from other organs. If the spasm forms one of the symptoms of progressive locomotor ataxia, the diagnosis will be comparatively easy. If the attacks are due to pressure from tumors, a bronchocle, etc., on one of the efferent

nerves, it will be shown by loss of motility in the muscles supplied by that nerve.

Prognosis.—Laryngeal spasm in adults varies considerably from the same disease in children, in that the attacks are rarely fatal, except when due to traumatism, or when they occur as a complication of œdema of the larynx. The prognosis depends on the cause of the spasm. If it be due to œdema, locomotor ataxia, etc., death may supervene in a very short time. As a rule, however, laryngeal spasm is very amenable to treatment, and fatal cases, except in the instances mentioned above, are very rare.

Treatment.—Absolute rest and freedom from excitement of all kinds should be strictly enjoined, and bromide of potassium or sodium, or some other sedative, should be administered until the nervous excitation has been controlled. The effort should then be made to find the cause and remove it. If it be due to atrophic or hypertrophic rhinitis, nasal polypi, deflected septum, or other pathological conditions in the nasal cavity, the proper treatment for these diseases should be instituted. Internally, valerianate of zinc, liquor arsenicalis, or syrup of the iodide of iron should be administered for some time after the acute attacks have abated. When the paroxysms are so severe as to imperil the life of the patient, tracheotomy must be resorted to, and the temporary insertion of a canula will often prevent any return of the spasm.

LARYNGEAL CHOREA OR LARYNGEAL VERTIGO.

There is a form of pure laryngeal spasm or laryngismus which is preceded by a peculiar tickling sensation in the throat, then the respiration is momentarily arrested in expiration, causing a loud harsh cough. Temporary insensibility often follows, and the patient may fall to the ground, but consciousness returns in a few seconds, and no stupor succeeds it.

The term laryngeal chorea or laryngeal vertigo has been given to this form of spasm, on account of the irregular choreic movements of the larynx. These spasms may continue during sleep without the patient being awakened by the sounds produced by the incoördinate action of the laryngeal muscles. Neither the noises nor the insensibility, however, are necessary accompaniments of the disease. It occurs much oftener in females than in males, and especially in those who are asthmatic or gouty. The difference between the spasm in chorea laryngis and the ordinary spasm is, that in the ordinary spasm the closure of the glottis occurs in the inspiratory effort, preventing the entrance of air into the larynx, whereas in the choreic spasm the closure takes place in expiratory effort and is therefore phonal in character. The cough of chorea laryngis resembles the bark of a dog so closely that the children suffering from it are known as "barking children." It comes on usually about the age of puberty, but cases have been met with in individuals from thirty-five to fifty-five years of age. In the two cases quoted below, the patients were aged about thirty-five and forty years respectively.

Diagnosis.—In regard to the diagnosis, Dr. Roe, of Rochester, New York, writes, "The diagnosis of chorea laryngis can only be made by a laryngoscopic examination. The peculiar cough usually attending this affection is not significant. In nearly all cases of laryngeal chorea the respiratory as well as the laryngeal branches of the pneumogastric are involved, giving expression in peculiar and involuntary coughs. Two cases have been reported by Knight, in which the choreic movements were confined entirely to the larynx and unattended by cough.

"Hysteria of the larynx is the only affection with which chorea laryngis is liable to be confounded. The characteristic manifestations of hysteria of the larynx are those of aphonia, spasm, anæsthesia, and hyperæsthesia; while chorea laryngis is characterized only by a peculiar choreic, incoherent action, or incoördination, or, as Watson terms it, an 'insanity,' of the laryngeal muscles."

Prognosis.—The prognosis seems to be extremely favorable, as all cases so far reported have recovered.

Treatment.—The most important part of the treatment is to remove all morbid conditions found in the upper air-tract, and the correction of all hypersensitive areas in the nose, pharynx, or naso-pharynx. Lennox Browne states that the treatment should be directed rather to the pharynx than to the larynx, but a case reported by Dr. Roe was greatly benefited by an application of a solution of sulpho-carbolate of zinc, extract of krameria, and eucalyptus to the fauces, and one of the cases quoted below was notably improved by the persistent local application of a solution of silver nitrate to the posterior pharynx. Cases have also been cured by the removal of an elongated uvula and hypertrophied turbinates.

Cocaine applied to the larynx seems rather to increase than to diminish the cough, but appears to have a beneficial effect when used as spray in the nose. Internally, liquor arsenicalis, valerianate of zinc, and bromide of potassium in large doses have given good results. Inhalations of steam alone, or of watery vapor impregnated with conium, opium, hyoseyamus, lupulin, etc., may be used. The administration of general tonics, and the application of cold water, to the head and neck especially, should not be neglected, as well as the correction of all disturbances of the genito-urinary organs.

CASE I.—The first case of chorea laryngis which I report was that of a spinster, aged about forty, white. She was of a neurotic temperament, with a very anæmic complexion. For several years past she had been subject to sudden attacks of closure of the glottis, lasting for several seconds, preceded by a violent cough, and recurring at varying intervals, especially during the winter. As she describes it, "she was rendered speechless, but not insensible." She had many years ago been subject to a very severe nervous strain, having witnessed the sudden and fearful death of a near relative,—since which time she has had but little control over her nerves. She was especially liable to take cold, and of course

her symptoms were aggravated at that time. Her sight and hearing were good. She had no aural vertigo, nor any stupor or mental confusion. The heart's action was sound, but inclined to be weak. There was no perceptible disease of the lungs. The posterior turbinated bodies were somewhat hypertrophied, and the larynx and pharynx were very pale, with profuse discharge of mucus, from which she constantly endeavored to rid herself by clearing her throat. Her menstrual functions had been exceedingly irregular, months frequently passing without any return of them. She had no special diathesis, except perhaps a slight malarial cachexia.

The laryngeal spasm was so annoying that she was obliged to take her meals in private, for fear that the excitement from the presence of others would bring on a paroxysm of coughing and a return of the spasm. There was no stupor or insensibility of any kind following these attacks. To test the irritability of the larynx, however, on her first visit to me, I passed a probe armed with a pledget of cotton into the naso-pharynx; instantly there was a spasmodic closure of the glottis and the patient lost her breath completely, her face became livid, and several seconds elapsed before she was able to regain her breath. The uvula being somewhat elongated, I first removed a portion of it, and then began a series of manipulations in the naso-pharynx, as advised by Lennox Browne, "that the treatment should be directed rather to the pharynx than to the larynx." A solution of argentic nitrate (5i to f̄3i) was applied to the naso-pharynx, alternated with the glycerin, iodine, and iodide of potassium solution, every other day. Sulphate of codeia, gr. $\frac{3}{4}$, was given her at night and repeated *pro re nata*, and the following spray was ordered to be inhaled every time the cough began,—viz.: eucalyptol, oil of pipsissewa, āā gtt. ii, menthol, gr. iv, benzoinol, f̄3iv. At the end of about a month she reported a complete cessation of the spasms and stopped treatment. At that time I could make any application to the naso-pharynx without exciting the slightest spasm of the glottis, and this freedom from spasm continued for perhaps two years, during which time she had no return of it of sufficient severity to cause her to apply for treatment again.

At the expiration of that time, however, she was brought back by her attending physician, and she then stated that she had had a violent and continuous cough all during her waking moments for three months previous, but not accompanied either by the spasm or by any loss of consciousness. Her behavior proved the accuracy of this statement, for she coughed so incessantly during her visit to me that she could only with difficulty describe her case. Her physician stated that he had tried every form of cough-mixture, anodyne, etc., without avail. Suspecting that it might be due to some reflex irritation from the gastro-intestinal tract, I ordered a mercurial cathartic, to be followed by the sulphate of codeia and inhalation as before, and I was myself surprised, as well as her friends, at the rapidity with which her cough was checked. At her next visit, on the third day, she reported that the cough had almost entirely left her, and the change for the

better was extremely noticeable. In a recent note she informs me that she has had occasional returns of the cough during the winter, but none of the spasmodic attacks, then or since, and adds that the cough was finally paralyzed by the sulphate of codeia (of which her family physician advised her to take three-fourths of a grain in powder three times a day), and that she was now enjoying a respite, which she hopes will never cease.

CASE II.—Like the first, this was a case of chorea laryngis, with paroxysmal cough. It was superinduced upon an attack of pernicious anæmia, but the symptoms of prolonged closure of the glottis, followed by insensibility, were both absent.

The patient was an unmarried woman, aged about thirty-five, white. She had had a persistent cough for several years past. She had also had one or more attacks of malaria, which finally culminated in a severe attack of pernicious anæmia. She was exceedingly pale, eyes large and easily suffused. The violence of the paroxysms of cough had increased greatly during the last two months previous to her coming to me, and she was correspondingly weakened and prostrated after them.

Her family history was unfavorable, she having lost a sister from phthisis. She had no heart-disease, nor was there any perceptible derangement of the lungs and bronchi. The mucous membrane of the larynx and pharynx was very pale and exceedingly sensitive to irritation, and there was considerable engorgement of the tonsillar tissue and vessels at the base of the tongue.

The mucous membrane of the nose partook of the general condition. The middle turbinate on the right side was hypertrophied, and pressure upon it by a probe would immediately set up a paroxysm of coughing. Referring to my notes on the case, I find that treatment for the first two or three weeks was without avail, and during this time many things were tried. She was given large doses of syrup of iodide of iron, Fowler's solution of arsenic, eucalyptol, sulphate of codeia, etc., internally; and locally, anodyne inhalations and applications of various astringents and pigments were made, among which was a solution of fluid extract of krameria, sulpho-carbolate of zinc, and eucalyptol, as advised by Dr. Roe, of Rochester, New York, and the tonsillar tissue of the base of the tongue was thoroughly cauterized with the galvano-caustic needle. Very little benefit was derived from all this, except that she seemed to think that the character of the cough had to a certain extent changed. I then noticed after using a ten-per-cent. spray of cocaine in the nose, which I did in order to facilitate examination, that, although her voice would become decidedly hoarse, her cough would be distinctly lessened while the effect of the cocaine lasted. She was, therefore, given a four-per-cent. spray of cocaine to be used in the nose during the paroxysms of cough, and the right middle turbinate was cauterized with the galvano-cautery. The effect was marked and satisfactory. The cough was materially lessened, and the patient's general health greatly improved. This improvement

continued for about two weeks, when I was obliged to leave the city for a short time, and a relapse occurred. The cough and incessant clearing of the throat returned with almost the same severity as at first, and the patient complained very much of weakness following the attacks. She was then ordered ferri carb. præcip., gr. xv, between meals, sulphate of codeia, gr. $\frac{3}{4}$ to i, at night, and the middle turbinate and lingual varix were cauterized. Improvement has again taken place, the cough has greatly diminished, and the patient's recovery is now assured.

It will be noticed in both of these cases that the treatment from which most benefit was derived was directed to the upper rather than the lower respiratory tract. In the second case the effect of cocaine in the nose is of especial interest, as most writers, notably Drs. Roe and Major, agree that cocaine when sprayed into the larynx is rather injurious than otherwise. The patient herself thinks that the cocaine spray had a better effect than anything else that was used, and so stated to me.

Spasm of the Larynx followed by Unconsciousness.—The following case has just occurred in the practice of the writer, and is thought worthy of insertion here.

The patient, an unmarried woman, æt. 52, at the menopause, was brought to my office supposing she had enlarged tonsils. She was of a very sanguineous temperament, inclined to plethora, and extremely nervous. So nervous was she that she expressed the greatest alarm when requested to walk back into the operating-room for examination. Her tonsils were found to be so small that they could not be caught in the grasp of either of two improved tonsillotomes, and they were therefore thoroughly cauterized with the galvano-caustic knife. She was ordered a simple gargle of listerine and water, and was especially cautioned against the taking of all hot foods, coffee, etc. She spent the first night without any untoward circumstance, and complained of no pain or difficulty of breathing. The next morning she attempted to drink some coffee which she said was not hot. Upon taking the first teaspoonful she complained of a peculiar giddiness and rushed to the window for air, but fell forward on the floor and was picked up unconscious. The attack lasted but a short time, and on my arrival soon after she had entirely regained consciousness and was comfortable. She was ordered hydrarg. chlor. mit., sodii bicarb., ãã gr. x, to be taken at once. On my return that evening I found that the powders had not acted, and the next morning she had had but one slight evacuation, showing that there was marked implication of the brain-centres, an opinion further strengthened by the fact that she complained only of great and persistent drowsiness. She has therefore been given strychnine gr. $\frac{1}{20}$ three times a day, and frequent small doses of saline cathartics, which have kept up a gentle purgation, and she now appears to be on a fair way to recovery.

LARYNGEAL PARALYSIS.

Paralysis of the laryngeal muscles, or akinesis, may be considered under several different classifications, as advised by Von Ziemssen, Sir Morell Mackenzie, Lennox Browne, Gottstein, J. Solis Cohen, G. M. Lefferts, and others, each having its special advantages, but want of space forbids an extended comparison of their respective merits in a paper of this brief character. Without confining ourselves, therefore, to any definite classification, we will consider—

1. Paralysis from disease or injury of the medulla oblongata and nucleus of the spinal accessory, or of the pneumogastric, superior laryngeal, and recurrent laryngeal nerve trunks.
2. Paralysis of individual laryngeal muscles.
3. Mixed paralysis.

LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE MEDULLA OBLONGATA AND NUCLEUS OF THE SPINAL ACCESSORY NERVE.

Etiology.—The most frequent predisposing causes of this disease are excessive mental excitement, exposure to cold, heredity, syphilis, and those conditions which produce locomotor ataxia, multiple sclerosis, and progressive bulbar paralysis.

Symptomatology.—In laryngeal paralysis due to a central lesion there are usually other symptoms of the disease affecting other parts of the system. As, for instance, there may be facial paralysis, or a loss of one of the special senses, or paralysis of one limb, or convulsions, may be produced. The laryngeal symptoms may vary greatly, in accordance with the severity of the disease and the nucleus most affected. If the motor nucleus upon one side is destroyed, all the muscles of one vocal cord will be paralyzed; or if only the adductor or the abductor filaments of the nerve are affected, there may be simple hoarseness, or great stridor in respiration.

Pathology.—Paralysis of the larynx due to central lesion is of course dependent upon disease of the roots of the spinal accessory in the floor of the fourth ventricle, and therefore occurs in connection with brain-affectations involving the medulla oblongata and pons Varolii.

Diagnosis.—The diagnosis of central laryngeal paralysis is dependent either upon the impairment of function of other organs, supplied by the spinal accessory or pneumogastric trunks, or upon the coexistent implication of other nerves. Those supplying the tongue, palate, and facial muscles are generally the ones affected.

Prognosis.—The prognosis is, of course, very bad. In syphilitic cases the disease may be checked.

Treatment.—The treatment must be entirely symptomatic. If the patient is syphilitic, the iodides and mercury must be administered. If both abductors are paralyzed, tracheotomy will be necessary. When the

affection is due to malignant disease the treatment can be only expectant, and such as will tend to euthanasia.

PARALYSIS FROM DISEASE OR INJURY OF THE PNEUMOGASTRIC.

Etiology.—The remarks descriptive of disease of the medulla oblongata and the spinal accessory nucleus would apply equally well to disease or injury of the pneumogastric within the cranium. Below the origin of the pharyngeal and superior laryngeal nerves the pneumogastric is liable to be involved secondarily, as the result of some pathological condition of the surrounding parts, such as benign or malignant neoplasms of the thyroid, secondary enlargement of the adjacent lymphatics from some constitutional cause, aneurism of the neighboring great vessels, etc.

Symptomatology.—The symptoms of laryngeal paralysis from disease or injury of the trunk of the pneumogastric are very similar to those of injury of the recurrent laryngeal nerves. The voice becomes weak or husky, but the sensibility of the larynx is either very little altered or quickly restored.

Prognosis.—The prognosis is unfavorable as regards restoration of function, and treatment is generally useless.

PARALYSIS FROM DISEASE OR INJURY OF THE SUPERIOR LARYNGEAL NERVE.

Etiology.—The only instances of this condition which have so far been recognized have resulted from diphtheria and enlarged glands, and from inflammation of the areolar tissue beneath the angle of the jaw.

Symptomatology.—The phenomena due to anæsthesia of the larynx have already been described elsewhere (page 671), so that it is only necessary here to describe the symptoms due to paralysis of the depressors of the larynx, of the thyro epiglottic and aryteno-epiglottic muscles, and of the crico-thyroid muscle. When the thyro-epiglottic and aryteno-epiglottic muscles are paralyzed the larynx cannot close, and the epiglottis retains its erect posture. This in combination with the anæsthetic condition of the larynx allows of the frequent passage of food into the larynx, there being no warning cough until the food passes below the level of the vocal cords. If the foreign body is not of sufficient size to cause at once symptoms of tracheal obstruction, an attack of pneumonia is likely to supervene in consequence of its continued presence. Complete bilateral paralysis of the crico-thyroids (the tensors of the vocal cords) may be recognized by the wavy outlines of the vocal cords. When the paralysis is unilateral, one cord will be higher than the other (Mackenzie).

Diagnosis.—The characteristic posture seen in the laryngeal mirror, and the total absence of sensation on the introduction of a probe into the larynx, will render the diagnosis simple. Bosworth¹ says, "I know

¹ Diseases of the Throat and Nose, vol. ii. p. 640.

of no lesion which will produce the curious glottis which is observed where both the superior laryngeal nerves are paralyzed,—viz., that in which the chink is divided by the approximation of the lips of the vocal processes. (Fig. 1.) If the paralysis is unilateral, the laryngoscopic image simply shows a relaxed condition of that portion of one of the vocal cords which extends from the vocal process to the thyroid cartilage."

Prognosis.—In complete bilateral paralysis of the superior laryngeal nerves the prognosis is very bad. When only one nerve is affected the danger is not so great. In the first case, the patient may perish either from inanition from refusal to take food, or from pneumonia from the passage of food into the trachea. Cases have been reported where death ensued from lobar pneumonia, and it could only be accounted for by the supposition that particles of food had passed down into the bronchioles.

Treatment.—The treatment will consist in the careful avoidance of the passage of food into the larynx, the patient taking his nourishment through an œsophageal tube passed below the laryngeal orifice. At the same time, galvanic and faradic electricity and internal tonics must be used to restore the motor functions of the muscles. Von Ziemssen recommends strychnine hypodermatically for this purpose.

PARALYSIS FROM DISEASE OF THE INFERIOR (RECURRENT) LARYNGEAL NERVES.

Disease or a traumatic lesion of the recurrent laryngeal nerves may produce either bilateral or unilateral paralysis of the vocal cords, in proportion to the extent of the disease or injury; and hence we must consider the two forms separately.

Bilateral Paralysis.—*Etiology.*—Bilateral paralysis of the vocal cords from disease or injury of the recurrent laryngeal nerves may be due either to central or to peripheral lesion. The peripheral lesion may consist of benign or malignant neoplasms of neighboring parts, the nerves becoming embedded in the newly-formed tissue, or an aneurism may by pressure interfere with the function of the trunk in transmitting efferent impulses. Tumors of the thyroid are not infrequently the cause of the affection under consideration.

Pathology.—The recurrent nerves and their branches are often found to be almost completely atrophied, leaving only the neurilemma remaining, or the nerve undergoes a fatty degeneration to a greater or less extent.

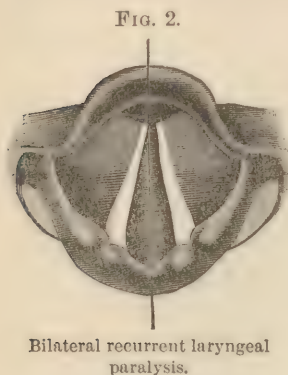
Symptomatology.—The symptoms will vary with the seat and extent of the disease or injury, and, as the adductor and abductor muscles are both supplied by this nerve, the diagnosis becomes more difficult. When the

FIG. 1.



Bilateral paralysis of superior laryngeal nerve.

trunks of both nerves are involved and both adductor and abductor filaments are paralyzed, the vocal cords will remain immovable in the cadaveric position (Fig. 2): the immobility and position of the parts are very characteristic, and the diagnosis is easy and conclusive. No dyspnoea is present in such cases, and the voice is very weak, much breath being required to make the cords vibrate, and the patient becomes quickly exhausted upon attempting to use the voice. Coughing and expectoration are equally difficult.



When bilateral or unilateral paralysis is incomplete, the symptoms vary in accordance with the amount of pressure upon the nerve-filaments supplying the adductors or abductors. It has been found that the abductor filaments much more frequently suffer from the results

of pressure than those supplying the adductor muscles.

Diagnosis.—The only affection with which this condition is liable to be confused is bilateral paralysis of the adductors, and nice discrimination will be required to differentiate between them. In bilateral adductor paralysis the cords will be seen much more widely separated, and the vocal processes are swung outward so as to give to the cords a somewhat concave appearance, whereas in bilateral recurrent laryngeal paralysis the cords will be seen lying midway between adduction and extreme abduction, or in the cadaveric position, the vocal processes slightly projecting into the glottic opening, in a direct line between the arytenoid prominence and the receding angle of the thyroid cartilage.

Prognosis.—The prognosis will depend on the cause of the affection and the extent to which the nerve is involved. When the paralysis results from diphtheria or an acute inflammation, complete recovery may take place in from three to six weeks. Where there is serious involvement of the trunks of the nerves and complete bilateral paralysis results, the outlook will be very grave, and after six to nine months' duration the cure of the case will be almost hopeless, except, of course, where the condition results from syphilis or some curable malady.

Treatment.—When the paralysis is due to diphtheria or one of the exanthemata, the usual constitutional remedies used to combat the sequelæ of these diseases may be administered. When there is a central lesion, or when the affection is due to malignant disease, aneurism, goitre, etc., appropriate measures must be resorted to for the removal of these causes. Electricity is of no avail, except in cases where the offending cause can be removed. Under such circumstances it should be continuously persevered in to keep up the proper stimulation and nutrition of the muscles. This can easily be done with the aid of cocaine, by placing one pole on the back of the neck and introducing the other directly into the larynx. When the

abductor filaments are affected and there is dangerous dyspnœa present, tracheotomy must be resorted to.

Unilateral Paralysis.—*Etiology.*—Paralysis from mechanical pressure on one or other of the recurrent laryngeal nerves is by no means uncommon, on account of the long course which they pursue before breaking up into their several branches. The left recurrent, being given off so deeply below the arch of the aorta, is liable to be pressed upon by aneurisms and other growths, and the right, on account of its close proximity to the apex of the lung in a part of its course, is very likely to be affected by disease of that organ. Cancer of the œsophagus, also, may affect one or both nerves.

Symptomatology.—In unilateral paralysis the voice becomes greatly weakened, and increased effort is required to carry the cord of the sound side across the median line into apposition with its paralyzed fellow. Hence the patient soon becomes exhausted; but after some weeks the larynx accommodates itself to the changed condition, and phonation then becomes easier, and after some months any variation in the voice becomes almost unnoticeable in ordinary conversation.

Diagnosis.—The diagnosis is best made by the aid of the laryngeal mirror. The cord on the healthy side, on phonation, will be seen to approximate to and even pass the median line, the corniculum laryngis on that side being also drawn down past its fellow, while the cord on the affected side will remain in the cadaveric position. There will also be corresponding obliquity of the rima glottidis, which will be deflected from before backward towards the paralyzed side (Fig. 3). In order to see this, the mirror must be held so that the centre of the crest of the epiglottis will be seen in a directly straight line with the centre of the arytenoid commissure during inspiration. During phonation the narrowed chink of the glottis will be seen to run obliquely with reference to the above line, while at the same time the cord of the paralyzed side will remain in the cadaveric position. It occasionally happens that the epiglottis is found normal but with its crest deviating several degrees from the median plane. This will give an exceedingly deceptive laryngoscopic image, and its possible occurrence must therefore be borne in mind. The laryngeal mirror now must be aligned with the soft palate and pharynx.

Prognosis.—This of course depends upon the cause, and upon whether the lesion involves the whole or only the filaments going to the abductor alone. In the latter case there will be probability of dangerous dyspnœa.

Treatment.—No local treatment is of benefit, except when there is great dyspnœa; then tracheotomy must be performed. If possible, the cause must be removed or modified.

Fig. 3.



Right recurrent laryngeal paralysis: position of cords in deep inspiration.

PARALYSIS OF INDIVIDUAL MUSCLES.

It has already been shown that separate filaments of the laryngeal nerves may be affected. It has also been found that the muscles themselves may become perverted in their function from inherent changes in the muscular fibres, not dependent upon any central lesion or nerve-disorganization. These changes may be entirely idiopathic, or they may arise in the course of many diseases, such as chronic rheumatism, progressive muscular atrophy, phthisis, typhoid fever, etc., or they may be due to over-use and abuse of the laryngeal muscles, or, again, they may occur under suspended or perverted volition (hysteria).

BILATERAL PARALYSIS OF THE ABDUCTORS.

Etiology.—Bilateral paralysis of the abductors occurs much more frequently in men than in women, and in adults than in children. It is not an uncommon occurrence in men, because the muscles affected are more exposed to accidental injury, etc., in them than in others (Mackenzie).

Bosworth¹ maintains, in opposition to the theory advanced by Semon that this form of paralysis is due to a special "proclivity" of these muscles, that it is far more reasonable to attribute it to "some central lesion" or morbid condition of the nerve-centres, and quotes a number of cases which were evidently due to bulbar disease. Syphilis, severe cold, wasting diseases, and deranged constitutional conditions form the most frequent exciting causes.

Symptomatology.—The voice may be normal or almost normal, with free expiration, but the vocal cords will be held almost in contact, and the inspiratory effort is very severe and greatly increased on the slightest exertion. During sleep the stridor is loud. With the laryngoscope the cords are seen to be only a line or two apart, the separation being greater on expiration than on inspiration. If the paralysis is only partial, the anterior half of the cords may be approximated while the posterior half is open, or one cord may be more affected than the other. Occasionally we find a unilateral paralysis subsequently becoming bilateral. Exertion always greatly increases the dyspnoea.

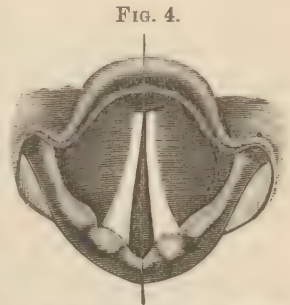
Diagnosis.—The diagnosis is very plain; it may be differentiated from spasm by the fact that in spasm the cords continually vary in their amount of adduction, while in paralysis they are immobile; the contracture of spasm is relieved during sleep, while in paralysis the stridor is increased during this period. The condition may be simulated by tumors below the cords or by hysteria, but careful examination will clear up these points. The laryngoscopic picture is well shown in Fig. 4.

Prognosis.—The prognosis is usually very serious, on account of the

¹ Transactions of the American Laryngological Association, September, 1888, p. 174, and May, 1890, p. 69.

natural results of obstructed respiration, unless it is due to hysteria or syphilis. Tracheotomy has frequently to be performed, and life can be prolonged for many years by the insertion of a canula. Those cases in which the disease develops rapidly seem to afford the best hope of ultimate recovery, but after the disease has existed for a period of eight or nine months degenerative changes in the muscles will have progressed to such an extent that a restoration of function will be almost impossible.

Treatment.—If the paralysis is due to a central lesion, of course topical treatment will be a waste of time. If, however, the lesion is peripheral, it will be necessary to remove all inflammatory troubles and to endeavor to restore mobility by the aid of galvanism and the internal administration of strychnine, etc. Even, however, when the cause is syphilis or other removable lesion, early tracheotomy is often necessary. The indication for the operation is, as Semon states, “when the objective widening of the glottis cannot be obtained by treatment within a short time.” Cases of myopathic paralysis more often require tracheotomy than those in which the paralysis is due to central lesion, and the operation should not be delayed until the dyspnoic symptoms render it urgently imperative, because both internal medication and local electrization give far better results when the cords are put at rest by the insertion of a tracheal canula. The point of insertion of the tube, in most instances, should probably be below the thyroid isthmus. Division of both recurrent nerves has been suggested, but the good results of this operation are by no means certain.



Bilateral abductor paralysis: position of cords in deep inspiration.

UNILATERAL ABDUCTOR PARALYSIS.

Etiology.—Like the bilateral form, this condition is most frequently due to a central lesion. It may, however, be produced by an acute catarrhal inflammation, by the impaction of some foreign body in the œsophagus, and by various diseases,—viz., gout, rheumatism, diphtheria, the exanthemata, etc.

Symptomatology.—There is usually slight stridor and dyspnoea on exertion, but the voice is not much changed, unless there is considerable congestion of the mucous membrane.

Diagnosis.—The diagnosis is easily made with the laryngeal mirror, as one cord on inspiration is not abducted from the median line.

Prognosis.—The prognosis in relation to the restoration of function will depend upon the extent and cause of the paralysis. If the muscular fibres are destroyed, the case is of course hopeless, but where the paralysis is due to simple inflammatory conditions the case will terminate favorably, and here, of course, electricity will be beneficial.

Treatment.—In simple acute inflammations warm and soothing inhalations should be used until the inflammation subsides. If it is due to syphilis, mercury and the iodides should be administered. Tracheotomy may be required in some cases.

BILATERAL ADDUCTOR PARALYSIS.

Etiology.—Functional aphonia, hysterical or nervous aphonia, as indicated by the descriptive titles, is found generally in women, or persons who are compelled to make great use of the voice. Respiration, both inspiratory and expiratory, may be normal, but whenever the muscles concerned in phonation are called into play the act becomes either very difficult or absolutely impossible. It is often one of the symptoms of anæmia and chlorosis. The truly hysterical cases are generally in patients in whom the sexual functions have become perverted. It is also often associated with loss of the power of articulation,—the tongue and lips remaining perfectly still on attempts at phonation. It should not be supposed because in most cases there is no demonstrable pathological lesion to account for it that this form of paralysis is assumed with the intention of deceiving. The patients are in most instances entirely unable to phonate above a whisper.

Diagnosis.—Examination by means of the laryngoscope reveals an imperfect coaptation of the vocal bands, resembling somewhat that seen in bilateral paralysis of the recurrent laryngeal nerves. The subjective symptoms simulate those of acute and subacute laryngitis, the presence of a foreign body in the larynx, or any growth which would interfere with the close approximation of the vocal cords. These conditions can all be differentiated with the laryngeal mirror. In recurrent laryngeal paralysis the cords lie in the cadaveric position and are absolutely motionless, all the intrinsic muscles being paralyzed, while in hysterical paralysis the cords are freely movable during respiration. Pure bilateral paralysis of the abductors is an extremely rare affection. Bosworth states that a cough is usually found in the hysterical variety, but is entirely lost in the genuine paralysis. In two cases of hysterical paralysis treated by the author, however, this symptom was absent. When the paralysis comes on in a healthy woman and is intermittent it is usually the hysterical paralysis, but it is often constant: so that this is not a diagnostic symptom of great value.

The first case above referred to was that of a clergyman who was otherwise in excellent health, and could speak clearly and with ease in ordinary conversation, but as soon as he began to preach or to read the services he would become hoarse and could with difficulty make himself heard. One application of the galvano-cautery to an enlarged follicle on the posterior pharynx seemed to restore his voice for several weeks,—as he described it, “in a startling manner.” The aphonia had existed in this case for over two years, and still exists, as the patient refused to submit to the application of electricity.

The second case was that of a neurasthenic woman, aged about twenty-

six, upon whom a variety of remedies were tried, with varying success. She regained her voice for several months after an operation for the removal of an echondroma of the septum narium, but became aphonic again. Resort was then had to the intra-laryngeal application of electricity, which has thus far sufficed to restore her voice whenever relapses have occurred. In this case and the one above, strychnine and other remedies were given until the constitutional effects of the drugs were seen, but there were no evidences of improvement in the aphonia.

Prognosis.—The prognosis is very favorable. Cases have been known to be cured in which complete aphonia had existed for six, eight, or ten years. The cases, however, yield slowly, and relapses are frequently liable to occur.

Treatment.—Emotional influences are often sufficient to cure these cases, and the physician should therefore make every effort to secure the confidence of such patients and convince them not only that they have a veritable malady, but also that it is entirely curable. Stimulating inhalations of ammonia or chlorine, the application of pigments, argentic nitrate, or perchloride of iron (3i to ii-5i) will prove of service in many cases. By far the most efficient of all remedies, however, is the intra-laryngeal application of galvanic or faradic electricity, or some sudden shock.

UNILATERAL PARALYSIS OF THE ADDUCTORS—CRICO-ARYTENOID.

Etiology.—This rare condition may be due to toxic poisoning, cold, muscular strain, syphilis, small-pox, phthisis, etc.

Dr. E. F. Ingals¹ says, "Although bilateral paralysis of the adductors of the vocal cords is a common affection, unilateral paralysis is not often met with excepting as a result of compression and injury of the recurrent laryngeal nerve, as, for example, in aneurism of the aorta, or malignant disease of the œsophagus. The affection is, however, met with in rare instances of lead and arsenical poisoning, and it is sometimes observed as a result of exposure to cold. It is sometimes attributed to rheumatism or phthisis, and is occasionally seen as a result of accident or surgical wounds. When accompanied by paralysis of the same side of the tongue or palate, it is of centric origin."

Symptomatology.—The affected cord is found closely applied to one side of the larynx, and remains so on attempted phonation. The voice is either lost or very hoarse, and the acts of coughing, sneezing, etc., are altered and have an aphonic or diminished phonetic character. This is one of the earliest symptoms. The larynx may be entirely free from any swelling or congestion.

Diagnosis.—It will require great care to distinguish between extreme abduction and the cadaveric position, because the furthest point to which the cord can be abducted during life is but little beyond that of the cadaveric

¹ Transactions of the American Laryngological Association, 1890, p. 66.

position. It is therefore very liable to be mistaken for recurrent laryngeal paralysis. During phonation the cord of the opposite side may be brought clear over to its fellow, and the arytenoid on that side will be brought in front of that on the paralyzed side (Fig. 5).

FIG. 5.



Unilateral adductor paralysis: position of cords in attempted phonation.

Swelling of the ventricular band is quite likely to be mistaken for adductor paralysis of that side, but careful examination will enable the observer to recognize the true nature of the case. Ankylosis or some impairment of motion at the crico-arytenoid joint may also simulate paralysis, but some enlargement or other abnormality about the joint will serve to distinguish that condition.

Prognosis.—The condition is not in itself dangerous, and, being due generally to local causes, the prognosis is usually favorable. Those cases which are due to syphilis or chronic toxæmia are quite amenable to treatment.

Treatment.—Some cases recover by the simple use of warm inhalations. In other cases strychnine and quinine should be given, the former in gradually increasing doses until one-tenth of a grain is taken three times daily. When syphilis or toxæmia is present, electricity must be used locally. If the condition has been of many years' standing, no treatment will be of any practical value.

ADDUCTOR PARALYSIS—ARYTENOIDEUS.

This muscle may be affected alone or in conjunction with the lateral adductors.

Symptomatology and Diagnosis.—The condition may be due to catarrhal inflammation or hysteria, or may occur during convalescence from some severe illness which has taxed the patient, and loss of voice is the most common symptom. With the laryngeal mirror the cords are seen to approximate well in the anterior two-thirds of the glottis. In the posterior third a triangular space is left, which does not close on phonation (Fig. 6).

Prognosis.—The prognosis in recent cases is favorable, but where the disease has existed for many years there is very slight chance of improvement.

Treatment.—The treatment should be directed to the amelioration of the catarrhal inflammation or the hysterical condition, or whatever is the underlying cause of the affection. Stimulating and astringent inhalations should be used, and where the condition has been of

FIG. 6.



Paralysis of the arytenoid muscle.

long standing faradism should be used, the intra-laryngeal electrode being applied to the inter-arytenoid fold.

PARALYSIS OF THE INTERNAL TENSORS—THYRO-ARYTENOIDEI.

Etiology.—This is by far the most common form of myopathic paralysis. As these muscles lie immediately below the vocal cords, they become involved in all the acute inflammations to which the cords are subject. Over-strain and prolonged use of the voice frequently form the exciting causes.

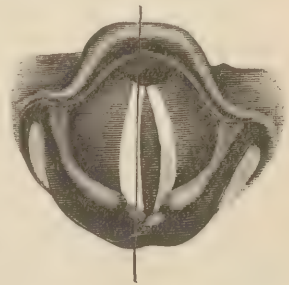
Symptomatology.—The most prominent symptom of paralysis of the internal tensors is the alteration in the voice. The tones become greatly weakened, and the range of the singing voice, especially in the higher notes, is very much diminished. The ordinary voice is not much impaired, unless the paralysis is very complete, when the voice assumes the character of a whisper.

Diagnosis.—The paralysis may be either bilateral or unilateral. When unilateral, the free margin of the affected cord, during phonation, will be seen in the laryngoscopic mirror to be slightly concave, due to the bellying up of the cord as the air is forced upward, the glottis having the form of a hemi-ellipse. This curved outline involves the whole cord from the thyroid angle to the arytenoid commissure, differing in this respect from paralysis of the crico-thyroid muscle, in which the ellipse extends only from the receding angle of the thyroid cartilage to the vocal process (Fig. 7). The vocal cords are in reality only tendons of the thyro-arytenoideus, so that when these muscles are paralyzed the normal flattened appearance of the cords is changed to that of a round whip-cord.

Prognosis.—The prognosis is unfavorable, unless absolute rest can be obtained, which is often very difficult in the cases where this form of paralysis is most seen. When due to local and removable lesions, the prognosis, of course, is more hopeful.

Treatment.—The treatment will depend greatly upon the history which the case presents. Absolute rest should be enjoined when practicable, and all straining and loud use of the voice should be positively forbidden. This is especially so in the case of singers and those who are dependent on the use of their voice for fulfilling their vocation. As in the cases of hysterical aphonia, there is no remedy so efficient as the faradic or galvanic current. This should be applied by the intra-laryngeal electrode; and a special set has been devised by Ziemssen for this purpose. I have found that an ordinary laryngeal probe armed with a wet pledget of cotton and attached to a galvanic or faradic battery has answered admirably in all the cases which have so far come under my observation. The application

FIG. 7.



Paralysis of right internal tensor.

should be made daily, one electrode being held in the hand or pressed upon the outside of the larynx of the patient, while the other is inserted into the larynx itself. This treatment should be supplemented by the internal administration of strychnine and tonics of iron, arsenic, etc., while plenty of out-door exercise, the cold bath, friction to the skin, and other general hygienic measures should be carefully enjoined upon the patient.

Mixed Paralysis.—Of course, various modifications of these paralyses will occur, and the shape of the glottis will be modified accordingly. Generally, however, the central and lateral adductors will be paralyzed, giving the glottis a triangular opening, or the internal tensors (thyro-arytenoidei) with the central adductors (arytenoideus proprius). Not only do combinations of paralyses occur, but spasm of one muscle and paralysis of another may be found, and the laryngoscopic image may undergo great variations in appearance and an accurate diagnosis will be exceedingly difficult.

REFLEX UTERINE NEUROSES OF THE LARYNX.

To all the neuroses heretofore described may be added many neuroses of a reflex character, dependent upon some disturbance in distant organs, and especially in the liver, stomach, and generative organs. The great paucity of literature on the subject, however, makes it impossible at this time to supply much accurate data. In fact, I have not been able to find any reference at all in the text-books to the subject of reflex uterine neuroses of the larynx, and, as my own experience has been very limited in regard to them, I will append a few extracts which have come under my observation, as showing the trend of professional opinion.

Dr. Carl Seiler, of Philadelphia, under date of January 29, 1892, writes,—

“I can very positively say that there is a peculiar neurotic reflex which produces peculiar pathological conditions in the mucous membrane of the larynx and pharynx, and which is due entirely to uterine irritation. The pathological condition of the larynx and pharynx and in some instances even the nasal cavities cannot be remedied by the ordinary local applications made by the laryngologist, unless the gynæcologist removes the distinct source of irritation. I have seen a large number of such cases, in which the result of the gynæcological treatment was perfectly wonderful.”

Dr. Edgar Holden, of Newark, New Jersey, says of pharyngeal neuroses due to uterine disease,—

“If we call to mind the familiar instances of the irritative cough of early pregnancy, or that at times arising from a displaced uterus, the dyspnoea from a similar cause, or the hemorrhoidal congestion of coronal headache, and conjunctival irritation from various uterine disturbances, the phenomena will the more readily appear to justify the diagnosis.” After reporting four cases of pharyngeal irritation which were relieved only after the removal of uterine disorders, he adds, “So many cases

similar to the above have been observed that it appears singular that no detailed account of them has as yet appeared in medical literature. It may be suggested that some form of stomach derangement, particularly that of acrid gastric secretion, might have given rise to the pains, as this is a common and familiar cause of pharyngeal irritation, but, aside from once entertaining this view and finding treatment unsuccessful, no symptoms of such difficulty were present in the cases included in this category. That the trouble was simply an ordinary neuralgia seemed disproved by the character of most of the cases and the absence of other neuralgias, and the subsidence of pain upon cure of the uterine disease."

I quote in full the able article of Dr. C. H. Leonard, from the *Journal of the American Medical Association*, July 9, 1892, entitled "Impairment of the Voice, in Female Singers, due to Diseased Sexual Organs."

"This is a subject not treated of, or even mentioned, in any of our text-books upon the diseases of women, so far as I am acquainted with them. Indeed, the only article I have seen upon the matter was one from Dr. Von Klein, of Dayton, Ohio, and appeared in a copy of *The Journal of the American Medical Association* of last year. In this article the doctor makes these statements: 'The most difficult cases the laryngologist has to treat are the diseases of the throat caused by the disturbance of the ovaries. It is a common thing to meet with cases of acute inflammation of the tonsils, larynx, pharynx, and fauces, in females, during the menstrual periods. I have observed the voice of many professional singers, who have applied to me for treatment during the menstrual period, to be defective in gravity, force, and timbre, producing, in many cases, a husky sound as of a low masculine order. In many cases of ovarian disturbance, enlargement and hypertrophy of the tonsils and soft palate are observed, hence the laryngologist can accomplish but little without the assistance of a competent gynæcologist.'

"To better introduce my subject, I will now read a letter from a quite noted soubrette who was under my care for some months for uterine trouble, and who had herself noticed a marked failure in her voice, but did not specially attribute it to uterine disease, until I particularly called her attention to it as the probable reason for her voice-failure. Her letter is dated 'December 5, 1889,' and reads as follows:

"'Dr. Leonard, I am now leaving here and have written in a hurry and do not know as I have given you the points you wished, but this one fact is conclusive, and that is, the sexual organs not only *go with the voice*, but *control* it. I have been an actress and singer for a number of years, and as my special trouble grew upon me my voice lost purity of tone, and also lessened its range, till, from a high mezzo, I could do only a contralto range. Now that I am nearly recovered I sing with greater ease and have regained purity of tone, whilst in the upper register of voice *I have gained two full tones*, and am firmly convinced that I should have lost my singing

voice entirely had I not had the special treatment by you. My improvement has been so great that the singing professor under whom I have been training, not knowing I was under special treatment, has taken to himself the full credit for my increased power and range of voice. Sincerely yours, etc.'

"Some two years after this, or during the past fall, the actress being in the city, she called upon me and reiterated what she had written me in 1889, saying that she had permanently retained the two upper notes that she had gained during my treatment, and that there had been no relapse of the special troubles for which she had been treated by me. She also gave the history of a friend of hers, another professional singer, that had an experience similar to her own.

"Now, while I do not think an increase of two notes in the vocal scale, from the treatment of a singer's sexual organs, is an occurrence to be expected in the majority of instances where a soprano may need a gynecologist's attention, still, I am satisfied that the popular notion that obtains with them—a huskiness of the voice at the time of the periods—is well founded; and I am sure my experience with several other cases would warrant me in asserting that the tone, pitch, and range of voice of female singers is seriously encroached upon whenever they have *any* disease of gravity affecting their sexual organs.

"It will be noted that Dr. Von Klein laid the greater stress upon the ovarian troubles. In the case of mine just reported, as well as in several other cases that have been under my care, the ovaries were not specially diseased; indeed, the ovarian symptoms were the least prominent, the main ones being uterine. In the case reported of the soubrette there was ante-flexion and narrowing of the uterine canal, with severe endometritis. These troubles were treated, and no attention paid to the ovaries, their recovery taking place without this. Of course the two organs, uterus and ovary, are so intimately connected arterially and nervously that a severe uterine inflammation may set up an irritation in the ovary; this I do not attempt to deny; by curing the uterine trouble the ovarian is cured as well. What I would specially wish to emphasize, then, in contradistinction to the claim set up in Dr. Von Klein's paper, is that to the uterus, more than to the ovary, we must look for the cause of imperfect voice in many of our female singers.

"When we consider the intimate connection of the uterus with the great sympathetic nervous system, and the frequent deleterious impression upon the stomach, heart, and head reflexly therefrom by the way of this nervous connection, it is but carrying the same reflex process one step farther when we assert its reflex influence over the organs of the voice. If good singers have themselves noticed this at their menstruations, and so have abstained as much as possible from the critical exercise of their voice at these regularly recurring periods, and many have told me that they

have noticed the prejudicial influence of these epochs over their voices, then it stands to reason that an inflamed or congested uterus will, at other times, also affect unfavorably the organs of voice and song.

"In tracing out the chain of nervous connections between the uterus and the larynx we find that, according to Bernard and Bischoff, if the spinal accessory nerve be cut or torn away, all the other cranial nerves remaining intact, there will be complete loss of voice. The same phenomena are observed if the inferior laryngeal be destroyed.

"The motor fibres of the pneumogastric, so far as the formation of the voice is concerned, are derived from the spinal accessory: the pneumogastric is specially brought under control of the uterus from its connection with the solar plexus that so freely supplies the heart and stomach. An inhibition of the spinal accessory could, physiologically, occur by a perverted nerve-influence set up at the uterine or inferior hypogastric plexus; this influence would be transmitted directly to the solar plexus and reflexly therefrom to the spinal cord, heart, and stomach, and then through the pneumogastric to the spinal accessory, recurrent laryngeal, and glosso-pharyngeal, thus paralyzing, in a measure, the motor influence of all these nerves over the muscles of phonation.

"The muscles governing pitch of voice are the crico-thyroid and the thyro-arytenoid,—the muscles of tension of the vocal cords. These cords vibrate from five hundred and seventy-two times (the gravest note) to sixteen hundred and six times (the highest note) each second of time, in our soprano singers. You can readily see, then, that the slightest impairment of the normal innervation must necessarily render organs so extremely delicate as these cords are deficient in their higher tensions and consequently imperfect in their range and action; huskiness, from the less tension of the vocal cords, would be one of the first symptoms of deficient nerve-influence, a loss of a tone or so the natural result of a greater impairment of its nervous tonicity.

"When you now combine these immensely frequent vibrations of the vocal cords, in the female, with the other muscle combinations taking place in the phenomena that we term phonation, remembering that there are something over one billion of these combinations with the other laryngeal muscles (for Bishop avers that for every modulation of the human voice there are at least one hundred muscles that must be brought into perfect co-ordination), we have the grand total of 20,000,000,000,000 of muscular combinations in phonation; when this is properly considered, I say, the only wonder is, not that an occasional lapse of co-ordination or the loss of a tone occurs, but that even in the most perfect health and training such exactness of the scale as is seen in the vocal accomplishments of our singers can ever be obtained.

"That there is this intimate connection between the nerves of the uterus and those of the larynx, as above claimed, I am positive, for I have time and again witnessed their reflex action on several of my patients.

One of the most distressing exhibitions of laryngeal spasm I ever saw was in the person of Mrs. S., forty years of age, and suffering from a large uterine fibroid. She had this reflex laryngeal spasm to such an extent that suffocation was imminent at each application of anything to the endometrium. I, as well as the patient, dreaded each bi-weekly visit, as she would strangle until she became black in the face, and lose consciousness, at times, at each application; any point of the uterine canal seemed equally sensitive whether probe, sound, or medicament was used. As the uterine irritation was progressing towards cure she had these spasms less violently; but the immediate and direct connection of the uterine nerves with those of the larynx was conclusively shown, dozens of times, to the students that were with me at my clinics, whenever this patient would call.

"I have under treatment at the present time a private patient that manifests these laryngeal spasms at each intra-uterine application, though to a much less degree of severity than the case just detailed. Still another private patient, though having no spasm, has a marked laryngeal pain at each application, and during the times of treatment complains of great pain in the larynx; indeed, the most of her pain is referred to this organ rather than to the uterus, though there is no laryngeal difficulty, but a marked endometritis. These cases of laryngeal spasm and pain are not the minor laryngeal difficulty known as 'globus hystericus,' a disease affecting reflexly the vocal organs and throat and which was well known in the time of Hippocrates.

"A further case of prejudicial influence over the voice from the reflex action of the pelvic organs, though seen in the male, is detailed by Dr. Sivers, of Fort Wayne, Indiana, in a recent number of the *Medical Age*. The doctor's case was one of chronic laryngitis where the patient could not speak above a whisper for two years and where the exciting cause of the trouble was found to be pile tumors in the rectum; proper treatment being applied to them, the difficulty of voice was permanently relieved. The nerve-fibres in the male pelvis are analogous and similar to those in the female: hence the results obtained in Dr. Sivers's case but confirm the position taken in the assertions I have made of the influence of the pelvic organs over the voice: a further analogue is seen in the modification of the voice in soprano male singers who have been subjected to castration."

PART II.

NEUROSES OF THE PHARYNX.

The neuroses of the pharynx may be divided into neuroses of sensation and neuroses of motion.

NEUROSES OF SENSATION.

The neuroses of sensation in the pharynx will exhibit very nearly the same group of symptoms as those of the larynx,—viz., anæsthesia, hyperæsthesia, paræsthesia, and neuralgia.

Anæsthesia.—Pharyngeal anæsthesia is not of any great clinical importance except as a symptom of progressive bulbar disease. It frequently results from diphtheritic paralysis, and is sometimes found in insane patients who have no paralysis elsewhere. When there is much loss of sensation in the pharynx, however, the larynx, velum, and surrounding structures will generally exhibit the same condition.

The continuous application of galvanism to the throat, and the internal administration of nerve tonics, strychnine, etc., are the only measures from which benefit may be expected.

Hyperæsthesia.—Abnormal supersensitiveness of the pharynx is one of the most prevalent of pharyngeal neuroses. It is found in patients who are perfectly healthy otherwise, and is one of the most frequent and difficult obstacles with which the laryngoscopist has to contend. The introduction of the Eustachian catheter becomes a difficult feat, in many instances, from the same cause. The sensibility of the pharynx varies greatly in different places: the most sensitive parts are usually the arch of the palate and the vault of the pharynx. Every variety of hyperæsthesia is found in hysterical patients and those who are subject to acute and chronic inflammation of the pharynx.

Treatment.—The treatment will depend chiefly upon the cause. In simple cases all that is necessary is to gain the confidence of the patient by gentle and persistent manipulation. The application of a spray of cocaine or resorcin will frequently render efficient aid. When there is any chronic inflammation or constitutional diathesis present, resort must be had to persistent application of astringents or caustics, and the internal administration of whatever remedies are indicated by the special diathesis present. The general treatment laid down for laryngeal hyperæsthesia will apply equally to hyperæsthesia of the pharynx.

Paræsthesia.—Paræsthesia of the pharynx results most frequently from hysteria, and frequently follows the removal of some foreign body. The sensations are generally those of a hair, fish-bone, or grape-seed sticking into the throat, as explained under the head of "Imaginary Foreign Bodies in the Throat." The condition is also a common symptom of sub-

acute and follicular pharyngitis. When it results from the presence of a foreign body, it will usually disappear in a few days after the removal of the foreign substance, but in some instances it will remain for months and years or recur at varying intervals, and a complete cure of the affection will then become a matter of considerable difficulty.

The treatment must be similar to that of laryngeal paræsthesia.

Neuralgia.—Many cases have been described of what has been termed neuralgia, myalgia, or rheumatism of the throat, but considerable difference of opinion seems to be entertained in regard to their exact nature and cause, as great difficulty is often found in locating the exact spot from which the pain emanates. Occasionally an enlarged follicle is found, after destruction of which the pain disappears, but these cases frequently occur in hysterical and nervous women where no follicular or other enlargements can be seen to account for the pain, and they are then to be regarded as the local manifestation of a general condition.

Sir Morell Mackenzie, in the last edition of his work, states that this condition has never heretofore been accurately described. He says, "Türk mentions some half-dozen examples (four occurring in females) where severe pains of the soft palate, principally on one side, were complained of. The affection appears to have been incurable in one instance, whilst the last recovered in a few weeks under the influence of strong applications of nitrate of silver. Some of these cases, however, approach more nearly to simple hyperæsthesia or paræsthesia than to neuralgia. Many instances of this condition have come under my notice. In most cases the patients were young women under twenty, but I have met with the affection in married women between thirty and forty. In some of these cases there was anæmia, and more rarely chlorosis, but many of the patients were otherwise healthy. In nearly all instances applications of tincture of aconite three or four times a day were of the greatest benefit, and this drug has often proved in my hands the only remedy which gave relief."

There have been several cases in the hands of the writer which have been materially benefited by local applications of argentic nitrate and the destruction of enlarged follicles, etc. As it is hardly probable that the local lesion, however, is entirely the cause of the trouble, the general system should be improved by the administration of iron, quinine, etc.

NEUROSES OF MOTION.

The neuroses of motion in the pharynx may be divided into akineses, or paralyses, and hyperkineses, or spasms.

Paralysis of the pharynx may be divided as follows: 1st, paralysis resulting from bulbar disease; 2d, paralysis resulting from diphtheria; 3d, paralysis complicating facial paralysis; 4th, paralysis of the constrictors of the pharynx.

Paralysis of the Pharynx from Bulbar Disease.—The forms of central lesion from which paralysis of the pharynx may arise are, acute and chronic

bulbar myelitis, hemorrhage, embolism, tumors, and basilar meningitis. The acute form of bulbar myelitis is characterized by the suddenness of the attack, headache, giddiness, dysphagia, and unsteadiness of gait, with interference with respiration and articulation. The symptoms increase with great rapidity until a fatal termination ensues.

The treatment should consist of active antiphlogistic measures, local blood-letting, ice-bags to the nape of the neck, the administration of some saline or hydragogue cathartic, and such treatment as is ordinarily used in spinal myelitis.

Chronic Bulbar Paralysis.—Paralysis of the pharynx may be one of the earliest symptoms of progressive bulbar lesion. Exposure to cold sometimes produces it, but more frequently it results from violent and prolonged excitement, bodily fatigue, and lack of nutrition.

Dr. L. Putzel¹ writes of glosso-labio-laryngeal paralysis or progressive bulbar paralysis, "Hardly anything is known concerning the origin of this disease. It is much more rare than progressive muscular atrophy. It appears to be more frequent in the male than in the female sex. Among eight cases of which the writer has kept notes, five occurred in men and three in women. In three of the cases (one woman and two men) the disease was complicated with progressive muscular atrophy. In one of the cases the disease began at the age of thirty-two years, and in the others between forty and sixty. It is rarely observed before the age of thirty-five years. Heredity seems to exert no influence in the development of the malady, and nothing whatever is known concerning the other predisposing causes. We also possess very meagre information concerning the exciting causes of the disease. A number of cases have been attributed to injury, excessive exertion of the implicated muscles, depressing mental emotion, and constitutional syphilis. But the influence of any of these factors is very problematical."

The malady in the majority of cases affects the tongue first, next the lips, and then the pharyngeal and laryngeal constrictors. In exceptional cases this order is not maintained. Duchenne observed paralysis of the velum palati and lips prior to that of the tongue, and that sequence will be seen in the case hereafter reported, treated by the writer. As the paralysis gradually progresses the difficulty in articulation increases *pari passu*, until speech becomes wholly unintelligible. Atrophy of the tongue finally supervenes, which will be noticeable by uneven indentations on its surface, and its long and short diameter will be lessened until the patient will be unable to protrude the organ sufficiently far to be grasped by the fingers. On account of the paralysis of the tongue, both mastication and deglutition will be very difficult. The food will become lodged between the cheeks and gums and in the teeth; phonation of all labials will be prevented. On account of the difficulty of swallowing, the saliva will constantly drivel

¹ Buck's Reference Handbook, vol. v. p. 573.

from the lips, and there will be a tendency to the passage of food and saliva into the larynx, and violent spasms of gagging and coughing will be set up, which may end in the death of the patient, through lobular pneumonia, from the introduction of a foreign body into the bronchioles.

A Case of Paralysis of the Pharynx, Soft Palate, Tongue, and Lips from Progressive Bulbar Disease.—The patient was a minister, who had been subject to very severe and prolonged mental strain from continuous preaching and teaching, with exceedingly poor nutrition, during several years. He had had five or six attacks of unconsciousness, the character of which he could not exactly describe, but not followed by any prolonged stupor. The first indication of any throat-trouble was a difficulty of pronunciation, and this was the only sign of the disease after the recovery from the attacks of insensibility. He consulted a specialist, who diagnosed a nasal obstruction of some kind and operated for its removal. This was followed by a pretty severe hemorrhage which returned at intervals for several months. On applying to me for treatment his condition was as follows. There was very evident loss of motion in the lips and cheeks. The nostrils were free from obstruction of any kind, and there was no lack of nasal intonation in the voice. There was, however, a complete loss of laryngeal timbre, the voice sounding as though there was some obstruction just above the glottis. Inspection revealed a marked drooping of the palate and pillars of the fauces. This the patient told me he could overcome by a considerable effort, and the voice would then regain to a certain extent its normal resonance. He was advised to use strychnine, gr. $\frac{1}{20}$, internally three times daily, and applications of electricity to the soft palate and as far back as he could tolerate the instrument. He received marked benefit from these applications, especially when they were made just before any effort at preaching. The patient moved away, and I lost sight of the case.

The disease usually runs a slowly progressive course and lasts from two to six years; death results from inanition or "foreign-body pneumonia" by the aspiration of food into the air-passages. Cardiac symptoms may also be prominent, from involvement of the nucleus of the pneumogastric; the pulse may either be excessively slow or the patient may have palpitation of the heart. Syncope may ensue, and repeated attacks of it may occur, from which the patient may recover completely, as in the case above reported, but death may result from one of the attacks. The intellect is usually unaffected throughout the entire course of the disease. The respiratory organs may also be affected: violent attacks of dyspnoea may occur without apparently any exciting cause, which may prove rapidly fatal.

Diagnosis.—The diagnosis is not a difficult matter, on account of the suddenness of the attacks, the locality of the resulting paralysis, and the chronic nature of the disease. It might be confused with bilateral facial paralysis, but the fact of the paralysis being confined to the cheeks would seem to fix the diagnosis though tongue and fauces be unaffected.

Prognosis.—The prognosis is almost always fatal. There may be brief remissions in exceptional cases, but the patient usually dies from inanition or pneumonia.

Treatment.—There is no treatment from which any permanent relief may be expected. Galvanism, strychnine, iodide of potassium, and nitrate of silver have been recommended, but no good results have been obtained from them. When inanition is threatened, the patient must be fed with the œsophageal tube, to prevent the passage of food into the larynx. Deglutition may be assisted by the use of electricity, the anode being placed on the back of the neck, and the cathode on the side of the larynx.

Paralysis of the Pharynx from Diphtheria and Membranous Sore Throat.—Paralysis of the pharynx and palate is one of the most frequent and earliest sequelæ of diphtheria and membranous sore throat. As the nerve-centres are always affected in diphtheria, and as the paralysis usually spreads, involving other organs, it will not be difficult to separate this form of paralysis from a somewhat similar condition which sometimes results from syphilis, putrid sore throat, tonsillitis, etc. In addition, the characteristic nasal intonation and loss of timbre will be very noticeable in the voice. There will be great dysphagia and liability of food to regurgitate through the nostrils or pass down into the larynx. In some instances the use of an œsophageal tube will be necessary to prevent fatal results. This accident is partly due to the implication of the depressors of the epiglottis. There will be considerable difficulty in expectoration of mucus, the accumulation of which will often cause vomiting in the effort to dislodge it. The senses of taste and smell are often blunted. On examination, the velum and uvula will be found relaxed, and the patient will be able to raise the parts only by an exaggerated effort at inspiration. The paralysis may be bilateral or unilateral, but one side is always more affected than the other. It usually comes on about fourteen days after convalescence has begun.

Treatment.—The treatment can only be prophylactic in character. Galvanism and faradism may be used every other day, until there is decided improvement. At the same time strychnine may be administered hypodermically or by the mouth. The food should be thick soups, or jellies of a very firm consistency so as to be easily swallowed, or the patient may be fed by the rectum.

Paralysis of the Pharynx complicating Facial Paralysis occurs when the lesion is above the geniculate ganglion.¹ The uvula is usually deflected to one side and does not move on phonation. The treatment is similar to that of facial paralysis.

Paralysis of the Constrictors is always associated with a similar condition of the œsophagus, and is characterized by marked dysphagia. The treatment is the same as that given for dysphagia due to œsophageal paralysis.

¹ See Ziemssen's Cyclopædia, vol. xiii. p. 496.

Spasm of the Pharynx.—Spasm of the pharynx may be produced by simple local irritation, or may occur as a symptom of very grave diseases. The milder forms may result from imperfect mastication, the presence of irritating substances in the fauces, chronic pharyngitis, globus hystericus. It is met with also as a symptom of acute inflammation of the parts, enlarged follicles in the pharynx, etc. There is also a form of muscular contraction in the fauces which is limited almost entirely to the soft palate and uvula, and may be regarded more strictly as a choreic spasm than those above mentioned. The muscle chiefly concerned in the condition appears to be the levator palati, as the palate is rapidly drawn up a number of times against the pharyngeal wall until the spasm is relaxed. A clicking sound is produced by the soft palate as it leaves the pharyngeal wall, which can be heard by the patient as well as those standing near. The movements can also be seen upon inspection. The cause of these rhythmical contractions, as in chorea laryngis, is very obscure, but they occur as an accompaniment of facial neuralgia, or as a symptom of paralysis agitans, and other nervous conditions. The more severe forms of spasm of the fauces occur in acute uvulitis, in œdema of the glottis, in hydrophobia, and as reflex symptoms of central tumors.

The most prominent indication for treatment is the removal of all possible sources of irritation, as any intra-nasal or pharyngeal growths, disorders, etc. When occurring in the course of other diseases, such as hydrophobia, acute uvulitis, and the like, the special remedies indicated for the treatment of these diseases must be administered. If it is due to a simple neurotic condition, the general health must be built up by the hypophosphites, iron, arsenic, etc. In addition to this, of course the regulation of the diet, clothing, out-of-door exercise, bathing, and manner of living must be carefully attended to, and all excitement, over-stimulation, etc. must be prohibited.

PART III.

DYSPHAGIA.

Etiology.—Difficulty in swallowing may be due to disease or injury of the fauces or œsophagus, or to reflex action from disease or injury of distant organs.

Among the local causes may be mentioned acute and chronic inflammation of the fauces, cancer, diphtheria, syphilis, tuberculosis, hydrophobia, foreign bodies in the throat, and hypertrophy of the papillæ circumvallatæ, introduction of caustic substances, retro-pharyngeal abscess, pressure from external growths, diverticula, aneurism, stricture, paralysis, spasm, rupture and malformation of the œsophagus, cerebral lesions producing paralysis of the velum of the palate, and general paralysis of the insane.

Symptomatology.—The symptoms of dysphagia are, first, pain in attempting to swallow, and often even while speaking or making any motion of the muscles of deglutition. The dull, aching pain is referred to the jugular region or to the sternal notch. Pressure on the larynx or trachea, or any motion, increases this pain; hence, when there is an acute inflammation, the patient holds his head in one position and complains of stiffness in the neck. Spasmodic contractions of the affected parts, and dyspnœa, may also be present.

Dilatation of the œsophagus above a stricture forms a more frequent cause of dysphagia than any heretofore mentioned, and is often due to the rapid swallowing of very hot food.

In spasmodic or paroxysmal dysphagia the symptoms will vary with the intensity of the spasm, from slight difficulty in swallowing to total inability. When regurgitation takes place, the food is ejected forcibly and without delay, as occurs when the dysphagia is due to organic stricture of the œsophagus. Some odynphagia may be present.

Dysphagia from globus hystericus is supposed to be due to successive waves of spasm occurring from below upward, or an inverse peristalsis of the œsophagus.

If an abscess is present, there will be rigors, high fever, and dyspnœa. In adults, the constant exspuition of frothy or glairy mucus is quite characteristic.

Diagnosis.—The diagnosis of the condition is much assisted by auscultation, as the exact spot at which the morsel or successive morsels are arrested can thus be told, and the spasmodic character of the disease proved.

It is often important to distinguish dysphagia due to spasm or malignant disease from that due to paralysis. In spasm the dysphagia is intermittent, the patient at other times being able to swallow quite well, whereas in paralysis or malignant disease there is little if any variation. In spasm there is often great difficulty in passing any instrument into the œsophagus, while in paralysis there is generally loss of sensibility and the instrument passes freely down without even the natural tendency to gagging present in health. There is no regurgitation in paralysis, in spasm it is well marked; while paralysis usually affects the old and feeble, spasm is most frequently met with in the young and hysterical, or in hypochondriacs, or those who are of a highly emotional nature. It is therefore much more often seen in women than in men. This form of dysphagia may occur as a mere psychical or hysterical phenomenon, or it may occur in the course of certain nervous diseases, such as epilepsy, hydrophobia, and chorea. It may also be due to severe and violent retching, or it may result from reflex irritation, the cause of which may be either in the gullet or at a distance from it.

In tetanus, epilepsy, hydrophobia, and chorea, the muscles of the œsophagus sympathize with the spasms of the other muscles. With the excep-

tion of foreign bodies, however, the most frequent cause of spasm of the œsophagus is the gouty diathesis, and it is supposed to be due to the frequent eructation of acid matter.

Diseases of the stomach and uterus may be mentioned among the distant reflex causes. Some women always suffer from dysphagia during pregnancy, and sometimes during lactation.

Prognosis.—Of course the prognosis of dysphagia is very favorable when it is of recent date and due to removable causes. When, however, there is serious central or local disease, or the dysphagia has been of long standing, the prognosis will be of the gravest import. Patients have been known to die in a very short time from dysphagia due to paralysis or spasm of the œsophagus.

Treatment.—If the dysphagia is due to simple acute œsophagitis, unless abscess or ulceration takes place, the difficulty will rapidly disappear under complete rest, with morphine hypodermically, anodyne applications, leeching, hot pediluvia, etc. The patient must be fed with nutritive enemata, unless the pain rapidly subsides.

If the dysphagia is due to traumatic causes, the symptoms and treatment must depend upon the amount of injury present and the cause, whether this be the ingestion of highly irritant solutions, powerful corrosive poisons, strong acids, or caustic alkalies, or injury done with suicidal intent, abuse of alcohol, pressure from without, etc.

When the dysphagia is produced by the presence of a foreign body in the œsophagus or in the larynx, or when there is considerable enlargement of the tonsillar tissue at the base of the tongue, such obstructions must be removed.

Of course, where dysphagia is caused by syphilis, diphtheria, or malignant or non-malignant disease, it is followed by a separate train of symptoms and must be treated accordingly.

The gravity of the results from dysphagia will vary with the cause of the affection, and the treatment must be modified to suit individual cases. The food should be either fluid in character or of a soothing and demulcent form. At the same time, it should be concentrated and highly nutritious, that small quantities may suffice to support the patient. This is especially the case where the dysphagia is dependent upon a cancerous or tuberculous condition.

When neither solids nor fluids can be swallowed, semi-solids will often be acceptable, as for instance an unbeaten raw egg, or an unseasoned raw oyster, or a glass of custard or rennet. In many instances if the throat be first sprayed with a solution of cocaine, resorcin, or morphine about ten minutes before the food is taken, the act of swallowing will be accomplished with less difficulty.

If the inflammation is very acute, or the ulceration or injury done to the parts has been very great, the patient will often refuse to swallow any form of nourishment. In these instances entire dependence must be placed

on rectal alimentation, or on the œsophageal catheter, where the œsophagus is not too much involved itself to admit of its introduction. Unless there is stricture of the œsophagus, it is often unnecessary to pass the catheter further than the pharyngeal constrictors. Mackenzie's œsophageal feeding-tube or the alimentation feeding-bottle (Fig. 8) suggested by Bryson Delavan is a very excellent apparatus for this purpose. It consists of a suitable catheter, attached by a piece of rubber tubing to a glass receptacle for the food. The latter, being of a sufficiently fluid consistency, is forced out of the catheter by means of a rubber bulb.

I have found that an excellent plan is either to induce the patient, if possible, to swallow a little vaseline or mucilage just before the catheter is introduced, or just as it reaches the constricted portion of the œsophagus to let the patient make the effort to swallow, when the stricture will open

and grasp the catheter, which can then easily be pushed down into the stomach. This also applies to dilating œsophageal bougies. When the most sensitive portion is found to be just at the palatine arches, the catheter may be introduced through the nostrils, and if violent gagging or dyspnoea is produced, or excessive pain, a dose of bromide of potassium may be administered, or the parts may be sprayed with a solution of hydrochlorate of cocaine, resorcin, or morphine. The value of this method of feeding cannot be over-estimated in cases of abscess, or of paralysis of the œsophagus, and in all instances where there is an inability to swallow in the natural way.

The medicinal treatment of these cases is also of importance. In the practice of the writer, many cases have been greatly benefited by the administration of from three to five grains of calomel placed on the back of the tongue and allowed to pass gradually into the stomach, this to be followed with a powder of trypsin, or some other digestive, administered in the same way a short time before any food is taken, and continued *pro re nata*.

When the affection depends on a serious disease of the general nervous system, the fundamental lesion must be treated. If the patient is hysterical, she should be braced up by moral as well as medicinal agencies. By passing a bougie into the œsophagus and assuring her that there is no obstruction, the cure may be accomplished. If there is a gouty diathesis, alkaline draughts or anti-rheumatic remedies should be given. Bromide of potassium, valerianate of zinc, and asafoetida are often of great benefit. The passage of a bougie alone, when there is no hyperæsthesia of the

FIG. 8.



Delavan's alimentation bottle.

mucous membrane, often controls the irritability, but it is well to precede this by the injection of some mineral astringent, such as chloride of zinc or perchloride of iron. A weak solution of argentic nitrate is often better than either (about grs. v to x to ℥j), introduced as nearly as possible into the seat of contracture by means of the œsophageal injector (Fig. 9).

FIG. 9.



Mackenzie's œsophageal injector.

If these measures do not cure the malady, galvanism will almost invariably succeed. The œsophageal electrode should be introduced into the gullet several hours before meals once every day for eight or ten days, and kept there about one or two minutes if the patient will permit it. A ten- or twelve-celled battery should be used. After that the application should be made only on alternate days, until the cure is completed.

The dietary should be carefully watched when the dysphagia is due to spasm. Warm and sweetened drinks are much better borne than cold ones, and thickened fluids are most easily swallowed. Stimulants and pungent, highly seasoned food should always be strictly prohibited, and solids should not be attempted until the cure is complete.

When the dysphagia is due to paralysis of the œsophagus, solids are more easily swallowed than fluids, as the muscular action of the œsophagus is more stimulated by hard particles of food. The danger here, however, of the passage of ingesta into the larynx would constitute a serious menace to life.

DEFORMITIES AND MORBID GROWTHS OF THE PHARYNX AND THE LARYNX.

BY LENNOX BROWNE, F.R.C.S. ED.,

Senior Surgeon to the Central London Throat and Ear Hospital; Surgeon and Aural
Surgeon to the Royal Society of Musicians; President of the British
Laryngological and Rhinological Association.

PART I.

DEFORMITIES AND MORBID GROWTHS OF THE PHARYNX.

THE pharynx is a locality in which, above all others, we might look for developmental anomalies, and these are due for the most part to conditions which can only be interpreted in the light of their direct or indirect association with the junction of the stomodæum and the foregut, and with the evolution of the branchial arches and clefts.

Few regions present greater difficulties to the bibliographer, for the record is by no means rich in specimens attributable to purely developmental causes, though further investigation will doubtless reveal many examples, presenting as it does a promising field for observation. As to abnormalities, and also as regards new formations, the microscopical reports of most of the older cases are so vague that only those of recent dates are of real value, notwithstanding that our present state of knowledge enables us to form a fairly approximate estimate of the nature of the earlier records.

The examples which will be quoted have been specially selected from the records of the last twenty-five years, and may be considered to be fairly representative. All those cases which are either imperfectly authenticated or described have been rigidly excluded, and examples have only been taken from those which can be unhesitatingly asserted to belong to the oro-pharynx and the laryngo-pharynx, that region with which this chapter is specially concerned. In fact, not with regard to any one portion of this article, but with the subject-matter as a whole, the author has set himself the task to give as far as possible the reflex of his own experience, and, with no desire to disregard the labors of others, has made no attempt—indeed, he has not the leisure—to achieve an encyclopædic compilation or to create an exhaustive bibliography.

Abnormalities of the pharynx may be conveniently divided into—

I. Malformations or deformities proper.

II. Growths.

I. Malformations consist of—

(a) *Stenoses.*

Primary, due to a congenitally imperforate state of the tube.

Secondary, due to some inflammatory process, intrinsic or extrinsic, constitutional or traumatic.

(b) *Pouches.*

1. Of congenital origin.

2. Due to degeneration of the walls.

II. Growths. Innocent or malignant, primary or secondary, which again may be either purely local in origin or due to some constitutional dyscrasia.

(a) *Innocent growths.*

Lymphomata,	}	Mesoblastic.
Fibromata,		
Myxomata,		
Lipomata,		
Angiomata,		
Papillomata,	}	Epiblastic or hypoblastic.
Adenomata,		
Teratomata,	}	Mixed.
Cystic,		

(b) *Malignant growths.*

Sarcomata,	{	Mucoid,	}	Mesoblastic.
		Lymphoid,		
		Fibroid,		
Epitheliomata,	{	Alveolar,	}	Epiblastic or hypoblastic.
		Stratified,		
		Columnar,		

(c) *Growths due to some inflammatory or constitutional cause.*

Syphilis,	{	Mucous tubercles.
		Condylomata.
		Gummata.

Tuberculosis.

Lupus.

I. MALFORMATIONS.

Congenital or Primary Stenosis.—Partial atresia of the pharynx originating *in utero* is generally situated in the lower portion, opposite to the cricoid cartilage, and usually appears as an annular fold of healthy mucous membrane about one-twelfth of an inch in depth;¹ but sometimes the

¹ Specimen No. 2294, Museum of the Royal College of Surgeons of England.

calibre of the tube may be reduced to as much as one-half of its diameter.¹ (Fig. 1.)

As a rule, there is no evidence of any inflammatory process.

There can be very little doubt that stenoses such as these are developmental in origin, and beyond the fact that they illustrate the frequency with which this locality is the seat of congenital anomalies, they possess but little surgical interest, notwithstanding that Sir Everard Home considered them as examples of stricture which are particularly suitable for treatment by bougies.²

Complete atresia is always associated with pouches, and will be treated under that group.

Secondary stenosis of the pharynx may be either intrinsic or extrinsic.

The intrinsic varieties are those due to—

- a. Suppurative inflammation.
- b. Tuberculosis (lupus).
- c. Syphilis.
- d. Traumatism.

a. *Stenosis due to diffuse suppurative inflammation* may arise at any age, and may possibly originate in other than septic causes, as from exposure to cold; but with the rapid advances of bacteriology, such a view is daily becoming less tenable. Of specific causes may be mentioned scarlet fever, diphtheria, small-pox, erysipelas, and the sepsis which attacks the too earnest worker in dissecting-room or hospital ward. It may also be a complication of tonsillitis and peritonsillitis. Probably those cases in which it appears to arise from the base of the tongue may be of the nature of an inflammation of the *lingual* tonsil. Where there is not any distinct evidence of specificity there may be a preceding rigor and rise in temperature; but the first noticeable symptom is generally dysphagia, with difficulty in moving the head. On examining the throat, the palate and fauces will be observed to be red and swollen, which condition may extend far down into the true pharynx. Not only the tissues of the neck but also the cervical glands will be similarly affected, and in some cases there will be an erysipelatous blush on the face. The general health will quickly suffer, vomiting, diarrhoea, anuria,³ dyspnoea, and cardialgia⁴ being among some of the more prominent constitutional disturbances to be observed. Death takes place early—generally within three days—even in those cases in which the pus has been discharged either spontaneously or by surgical interference. In the event of such evacuation,

FIG. 1.



Congenital stenosis of the pharynx.

¹ Specimen No. 2295, Museum of the Royal College of Surgeons of England.

² Museum Catalogue.

³ Campbell, of Hamburg, *Deutsche Medicinische Wochenschrift*, 1891, No. 35.

⁴ Hohlstein, *St. Petersburg Medicinische Wochenschrift*, 1891, No. 2.

the fetid character of the pus is an indication of the nature of the process, and on examination the pus will be found to contain numerous streptococci.

Post-mortem examination will generally reveal an abscess in the retro-pharyngeal space which may have escaped notice during life, and purulent infiltration will be discovered not only in the special regions which may have been seen to be involved, but possibly also in the mediastinum, pericardium, or kidneys.

The foregoing symptoms correspond with those relating to the conditions of the pharynx and larynx as described by Merklen,¹ Festier, and Cruveilhier respectively, and, inasmuch as in the more serious grades they are almost invariably fatal, it might be thought that these cases should not be included in the present section. But examples do, from time to time, occur of a less serious type, which terminate favorably, either by resolution or after free evacuation of the pus. The subsequent history of those which recover is, however, but too frequently one of more or less pharyngeal narrowing.

Stenosis of the pharynx due to (*b*) a primary acute *tuberculous* process is, as far as the writer's experience goes, unknown, and is to be seen only in that attenuated form of tuberculosis known as *lupus*. Stricture due to this last cause is comparatively rare, and is for the most part limited to that region of the fauces cicatrization of which, the result of previous ulceration, may shut off or greatly narrow the naso-pharyngeal passage.

c. Syphilitic stenosis of the pharynx is the commonest form of a dyscrasic nature, and, as in manifestations of the disease in other parts, is almost protean in its varieties. Some of the commoner forms due to adhesion of the soft palate to the faucial pillars and posterior wall of the pharynx, so shutting off the naso-pharynx from the oro-pharynx, much resemble lupus, except that the cicatrix of syphilis in this situation leads to more distressful constriction than does that of lupus, it being more fibrous in structure. Syphilitic stenosis is also often accompanied by curious outgrowths, the result either of an inflammatory process in fragments left after the early ulceration, or of an unequal atrophy of scar-tissue.

Prior to this cicatrization there will have been a more or less complete destruction of the soft palate, uvula, and tonsils, and in some cases the hard palate will also have been perforated,—a point of considerable diagnostic interest, first, because it excludes lupus as the original factor, and, secondly, because it points almost certainly to a coexistent nasal complication.

Sometimes concurrently with this upper stenosis of the pharynx, but more generally as another variety, a tight cicatricial membrane will be found stretching from the root of the tongue and posterior faucial pillars to the posterior wall of the pharynx, with a small button-hole opening, often not larger than a goose-quill, through which the epiglottis is sometimes to be

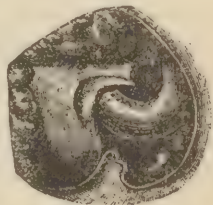
¹ Bulletin de la Société Médicale des Hôpitaux, November 7, 1890.

seen, resembling a bean-like foreign body.¹ More rarely still the epiglottis may itself be ulcerated; for, as a rule, the laryngeal ravages of syphilis are of subsequent date to those of the pharynx.

The superior stenosis of syphilis is common to the victims of the congenital as well as to those of the acquired forms of this disease, but it is rare to see the lower stenosis in those suffering with hereditary taint. Colcott Fox has, however, recorded an example of a girl, aged fourteen,² in whom there was a button-hole stenosis of the lower pharynx at about the level of the epiglottic attachment, the outcome of a gummatous infiltration of three years' duration, without any other signs of disease.

Syphilitic stenosis of the pharynx at the *entrance* to the œsophagus is decidedly uncommon, although specific strictures of the gullet itself are by no means infrequent. Robertson³ has recorded a very rare form of laryngo-pharyngeal stenosis in which the epiglottis was connected on each side with the oro-pharynx by means of dense fibrous membranes, leaving an aperture about the size of a pencil, through which one-eighth of an inch of vocal cords could be seen. In this lower region, where in some instances there may not be an actual stenosis, a certain amount of discomfort and obstruction to both swallowing and breathing may arise from the presence of peculiar outgrowths from the lateral walls of the pharynx, which may extend right across the glottis. Such a one is described by Morell Mackenzie,⁴ the illustration of which (Fig. 2) was made for him by the writer.

FIG. 2.



Syphilitic outgrowth from the pharynx.

Treatment of this condition is, as a rule, most unsatisfactory, and success will largely depend on the length of time the stricture has existed, to a certain extent also on the virulence of the specific poison in individual cases, and especially on the perseverance of both patient and surgeon. The writer is in the habit of practising a course of general mercurial inunction preliminary to any attempts at splitting or dilatation by bougies, accompanied by a persistent internal administration of iodides. The galvano-caustic knife has generally superseded the scalpel for these cases. It has been suggested by Nichols⁵ to pass silk sutures across and allow them to cut out so as to make a large opening for bougies. Of this procedure the writer has no experience.

*d. Traumatism*s leading to stenosis of the pharynx may occur in patients of all ages, but in the young are quickly fatal, by reason both of their

¹ Lennox Browne, *The Throat and Nose and their Diseases*, 3d edition, London, 1890, p. 208.

² *Lancet*, March 22, 1890.

³ *Journal of Laryngology*, vol. v. p. 460.

⁴ *Diseases of the Throat and Nose*, vol. i. p. 360, London, 1880.

⁵ *New York Academy of Medicine*, January 28, 1890.

acuteness and of the frequent delay in antidotal treatment, for they are almost always the result of scalding, an accident due, as a rule, to a want of watchfulness on the part of the parents; but in the adult the common cause is a fortuitous or intentional swallowing of caustic liquids, such as a solution of potash or of carbolic acid.

The writer for many years had such a case under observation, for which he applied dilating bougies two or three times a week, the patient using them during the intervals of his visits.

Another case allied to this class, which came also under the writer's notice, was that of a "sword-swallower" of some notoriety, named Benedetti, to whom he was summoned because a splinter of a Malacca cane introduced during his performance had fixed itself in the pharynx. This was easily seen and removed, but the parts were highly irritable and the necessary manipulations were attended with intense tenesmal spasm. (It was before the days of cocaine.) Inspection of the pharynx showed it to be so hyperæmic as to resemble raw beef in color. The writer warned the patient of a probable stricture whenever he should desist from passing his "professional bougie," to which Benedetti at once replied that he was fully aware of this, for if he did not go through his performance in his own room each Sunday he would often find great difficulty in achieving his feats before an audience on the following Monday. This prognosis was never verified, for the man died about a year afterwards from alcoholic phthisis.

The tenesmal symptoms in this case suggest the necessity of allusion to spasmodic stricture, which is, of course, important to diagnose from a true stenosis. This can generally be determined by the bougie. The causes are much the same as those which are liable to lead to pouches in the adult,—namely, the too hurried swallowing of imperfectly-masticated food,—the subjects of the complaint generally having a deficiency of natural teeth or imperfectly-fitting artificial ones.

Extrinsic Stenoses are due chiefly to disease of the vertebral column or to an enlarged thyroid gland.

Two cases due to vertebral disease which have occurred in the writer's experience may be quoted. The first is that of a gentleman, aged fifty,¹ who came under notice in 1877, and in whom there was a forward curvature of the spine involving the second, third, fourth, and fifth cervical vertebræ. Although this deformity had existed since childhood, no inconvenience was observed until after an attack of Indian fever, when the patient complained of difficult deglutition, some shortness of breath, and an accumulation of fetid phlegm. On examination, a large tumor was seen to project from the posterior pharyngeal wall. It was hard and circumscribed. Immediate temporary relief was given on elevation of the head by placing one hand under the chin and another under the occiput, and an instrument

¹ Op. cit. p. 226.

was adjusted which afforded similar support; this was soon replaced by suspension, the value of which was verified by a letter received from the patient after a silence of fifteen years, and, curiously enough, on the very day this article was commenced. The patient remarks that suspension is the only treatment which has proved of real service to him, and on one occasion when he left it off for a few weeks he suffered with constant headache. One portion of his experience is of great practical value. Owing to the great interdental pressure, he has lost his teeth, and only when it was too late to save the majority of the upper dental series did he discover the advantage of the insertion between the jaws of a piece of india-rubber during his periods of suspension.

The second case is more recent, and may be given in detail. A man, aged seventy-seven, presented himself at the Central London Throat, Nose, and Ear Hospital in November, 1891, complaining of great difficulty in swallowing and breathing. His condition was critical, the patient being greatly emaciated and suffering with a severe paroxysmal cough associated with expectoration of a considerable quantity of blood-stained and fetid sputum. It was impossible to obtain a satisfactory laryngoscopic examination, and the case was provisionally diagnosed as one of pharyngo-laryngeal cancer. His symptoms commenced two years previously with slight cough and occasional pain on deglutition, which continued off and on till fourteen days before admission, when he was seized with considerable dyspnoea, hoarseness, and odynphagia. An œsophageal tube was passed, but could not be introduced farther than about the level of the cricoid cartilage. Food was therefore given per rectum till death, which took place from asethia four days after admission.

Post-mortem examination revealed an ulcerated patch about two inches in circumference on the posterior wall of the pharynx. The edges were not thickened, but were firmly adherent to the vertebral column. At a point exactly opposite to the ulcer the anterior common ligament of the spine was destroyed and the corresponding centrum (fifth cervical) was in an advanced stage of caries, but the adjacent disks appeared to be quite healthy. The mucous membrane covering the pharyngeal aspect of the cricoid cartilage was brown in color, thickened, and also (slightly) ulcerated. Beyond some partial œdema, the larynx was healthy and no other signs of disease were found.

It is perhaps interesting to note that this man had never met with any accident, and gave no history of syphilis, but a brother had died suddenly with an abscess in the throat.

This case is of interest as illustrating both the difficulty of diagnosis and the possibility of caries occurring during second infancy. Although there were no indications, it is quite likely that the disease was slumbering for many years, and became conspicuous only with the advent of senile decay.

A third highly instructive case has recently been related by Mr. Edmund

Owen,¹ of St. Mary's Hospital, and is of especial value in that it enforces the necessity for accurate diagnosis of diseases associated with this region.

A girl, aged nineteen, had for many years suffered with severe headaches for which no clear explanation was given and no available treatment found. After being treated three weeks at another general hospital for "rheumatism," a post-pharyngeal abscess was discovered, with distinct evidence of cervical caries. At that time she could neither turn nor nod her head without difficulty and pain, nor could she tolerate pressure on the vertex. The painful localities corresponded with the distribution of the branches of the great occipital division of the second cervical nerve and of all the branches of the superficial plexus of both sides. The great and lesser occipital were those principally distressed, indicating that the disease chiefly involved the first and second vertebræ.

The post-pharyngeal abscess was opened, which afforded temporary relief to the deglutitory and neuralgic symptoms, but the girl gradually became hectic and weaker, Cheyne-Stokes breathing supervened, and after several days' unconsciousness she died, five months after admission.

Post-mortem examination revealed a considerable collection of pus about the atlas and axis, with destruction of the transverse atlo-axoid ligament and consequent forward displacement of the atlas and occiput, with the result of causing pressure on the cord by the odontoid process. There was also purulent and tubercular infiltration about the third and fourth vertebræ, with great thickening of the membranes in that region, which was itself partly responsible for pressure-symptoms.

It may be remarked that the patient's family history was very suggestive of a tuberculous dyscrasia, for out of sixteen brothers and sisters only six were living; this, combined with the wasting, the fixation of the head, the marked symmetry of the pains, and a *pharyngeal examination*, should have sufficiently differentiated the disease from rheumatism, the diagnosis which had been given prior to the patient's being seen by Mr. Owen.

As to the treatment of a retro-pharyngeal abscess, the laryngoscopic expert will probably elect to open it from within by the aid of his mirror, and the writer has seen excellent results from this practice; but it is beyond question that drainage and medication of the abscess-cavity can in most cases be better effected by an external opening, the situation of which must necessarily vary in each case; moreover, it must not be overlooked that there is a considerable element of danger of pus and blood passing into the trachea when the opening is made through the mouth.

Retro-pharyngeal abscess arising independently of vertebral disease requires no more than mere allusion; the same may be said of aneurism.

Nor need much space be occupied with stenosis of the pharynx due to the pressure of *goitre*, for in such a case the respiratory distress is of so much greater moment than the deglutitory that it generally claims the

¹ Lancet, January 30, 1892, p. 252.

first attention. But it may be remarked that in cases of pharyngeal pressure there is always hypertrophy of the apices of the lateral lobes, which appear to grow inward, and, exciting spasm of the hyoid muscles, cause sensations which the patient describes as throttling. It is also important to note that many of the operations for the relief of respiratory distress—*e.g.*, division of the fascia, removal of the central lobe, etc.—may not have any effect upon the conditions under consideration, the relief to lateral pressure being incomplete.

Hodgkin's disease, if the cervical glands are involved, may also tend to stenosis of the pharynx, and the same may occur when the glands are secondarily involved in a carcinomatous process originating elsewhere. In the latter circumstance, however, the intrinsic cause is, as a rule, sufficient to account for the pharyngeal constriction and its consequent symptoms.

An extrinsic cause of some rarity is illustrated by a case which was under the care of Dr. Orwin, a colleague of the writer.

A man, aged thirty-eight, was admitted to the Central London Throat, Nose, and Ear Hospital complaining of a swollen throat and difficulty in swallowing. Five months previously he had a hard sore on his penis, for which he was six weeks under treatment at the London Lock Hospital. After his discharge he suffered with severe pains in the neck and in the back of the head. About six weeks before admission his "throat" commenced to swell and became very painful.

On examination, a large mass was seen to be present on the posterior pharyngeal wall, and to extend from the level of the soft palate as far down as the level of the cricoid cartilage. It was dense, non-fluctuating, somewhat tender, and adherent to the vertebral column. The surface was covered by apparently healthy and unbroken mucous membrane.

Under the influence of iodide of potassium the swelling diminished and the dysphagia was greatly relieved.¹

A similar case is recorded by Houtang,² which presented almost identical features, but without any specific or tuberculous history. Nevertheless, syphilis being suspected, treatment upon that diagnosis proved the surmise to be correct.

The chief lessons to be learnt from the foregoing illustrations are the importance of an exhaustive pharyngeal inspection in all cases accompanied with cervical pain (especially when symmetrical) and the differential diagnostic value of a constitutional history.

Pouches.—Pouches or saccular dilatations of the pharynx present themselves under two aspects, one of which is purely due to defective development during the fetal state, the other being in the majority of instances brought about either by an imperfect growth of tissues or by mere mechanical distention. It is, however, difficult to believe that simple

¹ An interesting point in this case is the unusually early development of a gumma, after primary infection.

² *Annales des Maladies de l'Oreille et du Larynx*, Paris, February, 1888.

stretching could give rise to such a condition, surrounded as the pharynx is with its powerful constrictors, unless there were some predisposing cause for weakness, such as paralysis or absence of one set of muscular fibres, or perhaps some degenerative state of the walls, traumatic or constitutional.

Congenital pouches are almost invariably associated either with complete atresia of the pharynx or with absence of the œsophagus for some distance. An illustration of the latter state is beautifully shown by a specimen in the Museum of the Royal College of Surgeons,¹ in which the pharynx ends in a *cul-de-sac* or pouch about the level of the cricoid cartilage, the œsophagus springing from just above the tracheal bifurcation: so that the larynx and trachea were made to perform a double function. Some fibres of the œsophagus could be traced upward behind the trachea as far as the pouch.

FIG. 3.



Congenital pouch and atresia of the pharynx.

Several cases very similar in their arrangement are recorded, but there is another variety in which the pouch ends at a point just below the level of the cricoid cartilage and constitutes a complete atresia of the pharynx, with absence of communication with the foregut.²

As to etiology in this, as in all other congenital anomalies, we can only speculate; but a condition is occasionally present which may throw considerable light upon the matter,—viz., that of displacement of the right subclavian artery, which in one case is reported as arising on the left side of the spinal column from the descending part of the aorta: its course lay immediately behind the trachea in the exact position of the œsophageal gap. This abnormal course of the right subclavian is due to a persistence of the fourth right aortic arch; when present in the vestigial form it is known as the *arteria*

aberrans.³ Although only one of the cases recorded is said to present this

¹ No. 394.

² Specimen 394 A, Museum of the Royal College of Surgeons. See also Transactions of the Pathological Society of London, vols. iii., vii., viii., and xxvii.; also Edinburgh Medical Journal, 1869, and Sydenham Society's Retrospect, 1891-92.

³ Macalister, Text-Book of Human Anatomy, London, 1889, p. 555.

peculiarity, it is reasonable to assume that it may have been present in at least some of the others.

Dilatations and pouches of the pharynx (pharyngoecele) due to conditions which cannot be attributed to developmental eccentricities are doubtless common, but, occurring as they do in the aged, and rarely giving rise to any well-marked symptoms, it is probable that they are not infrequently overlooked or their importance discounted.

When the pouch is sufficiently large to interrupt the act of deglutition, the patient soon becomes aware of his deformity, and completes the act by external digital pressure, as occurred in the case¹ from which the specimen here figured (Fig. 4) was taken. Like most of this class, it occurred in advanced life, the patient, who was a bishop, being ninety years of age.

The pouch, about two inches long, was situated in the lateral wall only of the pharynx, and was formed by a hernia-like dilatation of the mucous membrane, over which the continuity of the constrictor muscle was interrupted. It opened by a wide orifice and was lined by healthy tissue. This is the situation in which the pharyngeal wall is most liable to give way, receiving as it does the full force of the second act of deglutition when the powerful constrictors are at the maximum degree of contraction.

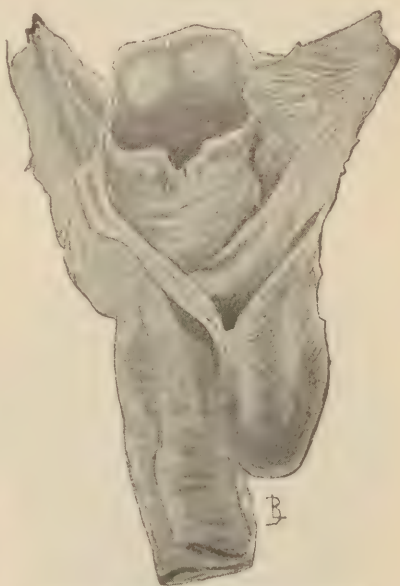
Given a weak point in the pharyngeal wall, the habit of "bolting" large masses of food would in time produce the condition described, and correction of this habit perhaps is the most rational and effective treatment.

II. MORBID GROWTHS.

Primary growths in the region of the true pharynx under our notice are, according to daily clinical experience, uncommon, though the contrary has been asserted by Morgan.² But many of the cases quoted by this author to prove his position are not truly pharyngeal, but have originated from the base of the skull or from some other adjacent

structure, and have invaded the pharynx secondarily. It is difficult in the present state of the records to decide with any degree of certainty whether the innocent or the malignant varieties are the more numerous; for although many of them may be histologically benign in nature, their situation in the

FIG. 4.



Pouch of the pharynx in advanced life.

¹ No. 2291, Museum of the Royal College of Surgeons.

² Transactions of the American Laryngological Association, 1883, p. 167.

"prima via" must of necessity endanger the life of the patient, either directly from interference with respiration and the taking of food, or indirectly by a predisposing influence to inflammatory processes in the larynx, lungs, etc. Moreover, in the older accounts, growths of the pharynx which were polypoid in contour are frequently described by the ambiguous term "polypus," though many of them are neither myxomatous nor fibromatous in their minute structure.

INNOCENT GROWTHS.

Of this group the *lymphomata* or *lymphadenomata* are the most common forms, because they generally arise from the lymphoid vestiges, or the tonsillar tissues so persistently present in this region. Several examples have occurred in the writer's clinic, one of which will suffice for illustration.

A female, aged forty-eight, came under treatment in June, 1891, for dysphagia of two years' duration. On examination, the whole of the right side of the pharynx was occupied by a lobulated pink mass which apparently invaded the corresponding tonsil. On the opposite side a similar but smaller mass was visible. A view of the larynx was not obtainable. There were swollen lymphatic glands in the neck, axilla, groin, etc. The patient was extremely anæmic, and her blood showed deficiency in red corpuscles, whilst the white were increased in the ratio of one to two hundred of the red. Dyspnœa and palpitation being also very severe, it was decided to remove as much as possible of the growth, which was done with the cold-wire *écraseur*, in two sittings, and with marked relief to the distressing

symptoms. She was subsequently treated with iron, arsenic, and two grains of iodoform twice daily, under which the glands rapidly diminished, and she was discharged in less than a month, to use her own words, "completely" —at any rate practically—cured.

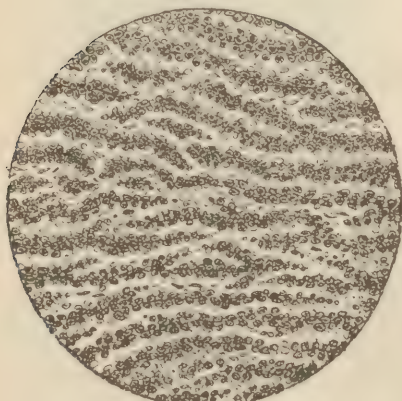
A drawing of the microscopic section is here shown;¹ the tissue consisted of lymphoid cells embedded in a faintly reticular matrix. (Fig. 5.)

The interest of this case is that it illustrates the effect which surgical removal of an obstruction to the vital process of respiration may have

upon a patient's general state and upon the growth of similar hypertrophic tissue in other parts of the body.

The tendency to multiplicity must always be borne in mind in connec-

FIG. 5.



Lymphoma.
Obj. $\frac{1}{3}$, oc. 3, $\times 120$.

¹ All the histological drawings in this article were taken from preparations made by my colleague, Mr. Wyatt Wingrave.

tion with this class of growth, since it may also be attended or followed by mediastinal deposit.¹

A pharyngeal lymphoma, when occurring as a solitary pedunculated mass,² is not easy of diagnosis, but it is so frequently associated with gradual soft enlargement of the near and distant lymphatic glands that its nature should be easily recognized, especially when associated with hæmal changes.

Fibromata may be placed next in order of frequency, for doubtless many growths belong to this class which may have become mucoid secondarily, while others which were originally myxomatous may have become fibroid. They generally occur in youth or mid-life, and, like other mesoblastic neoplasms, rarely in old age. The structure consists for the most part of densely-packed, elongated spindle-cells with a variable quantity of matrix; they are nearly always encapsuled, and often pedunculated; of very slow growth, and generally single. Histologically it is often difficult to draw the line between this kind of growth and the sarcomata, therefore one must be guided to a great extent by the clinical evidence.

When pedunculated, removal by means of a galvanic éraseur proves very satisfactory; but when sessile, the writer has experienced considerable success from electrolysis, the tumor disappearing permanently after a series of from twenty-five to fifty sittings.

A girl, aged eighteen, is at the time of writing under treatment at the Central London Throat, Nose, and Ear Hospital, who has complained of "something growing in her throat" for two years and a half. The swelling is now apparently stationary, she enjoys excellent health, and her voice is of good volume, but she has occasional attacks of dyspnoea. A pale, firm, pedunculated mass, about the size of a pigeon's egg, is seen projecting into the pharynx from behind the left tonsil; it is painless, moves with deglutition, and is seemingly continuous with a larger mass which can be felt externally behind the angle of the mandible on the left side. The left vocal cord is fixed in the cadaveric position.

These growths do not, as a rule, grow very large, but one is reported by Bruns³ which almost filled the fauces; under electrolysis it entirely disappeared.

Another case under the care of one of the writer's colleagues was completely enucleated by the fingers after an incision of the mucous membrane.

Myromata of the true pharynx are so rare that no case can be recalled in the writer's experience nor found in the records which he has searched, but dilatations of mucous glands causing mucocœles are of quite frequent occurrence and call for no special remark.

Lipomata are by no means common, and may be either pedunculated or

¹ Villar, Société Anatomique, March, 1888.

² No. 2325, Museum of the Royal College of Surgeons, London.

³ Berliner Klinische Wochenschrift, 1873, No. 84.

senile. A clinical illustration of the former is that recorded by Barnard Holt.¹ It completely filled the pharynx and extended downward into the œsophagus. The patient died suddenly from suffocation whilst smoking.

This case exemplifies the tendency which fatty tumors have to increase when the resistance is slight, but when associated with denser tissue their growth is more limited and they become sessile, a condition well shown in the case² recorded by Frederic Taylor of a girl, aged four, who was admitted into the hospital on account of dyspnœa of fifteen months' duration. There was an oval, soft, elastic swelling on the posterior wall of the pharynx measuring three by three and a half inches and extending from the level of the soft palate downward. Its limits were ill defined. It was diagnosed as retro-pharyngeal abscess, and punctured, with negative results. Sudden dyspnœa supervened, and the child died after tracheotomy had been performed.

Post-mortem examination revealed a lipoma growing in the retro-pharyngeal tissue and closely adherent to the vertebral column and pharynx.

The main interest in this and other cases of sessile post-pharyngeal tumors is the diagnosis from retro-pharyngeal abscess and vertebral disease. Although much information may be obtained by palpation, still, this must be corrected by a careful search for indications of caries, an exhaustive history, and a consideration of the general state. Age constitutes an important factor; for whilst pedunculated lipomata may occur late in life, the sessile and deeply-seated forms are more often congenital. Thermometric variations should also be of value if the general symptoms are sufficiently mild to permit of time for their observation.

The treatment of the polypoid form is obvious, and may be sometimes successfully carried out *per vias naturales*, even without a preliminary tracheotomy. For the sessile variety, though enucleation may occasionally be successful, in which case it should be effected by a lateral pharyngotomy, a preferable treatment is that of electrolysis,—a measure which gives all the more hope of relief inasmuch as tumors of this nature have some disposition in this as in other regions to disappear spontaneously with evolution of years.

Angiomata.—Considering the vascular nature of the region, tumors composed chiefly of blood-vessels ought not to be uncommon, but the records are not very rich in specimens. At the back of the pharynx, behind the mucous membrane, is an oval cluster of veins, known as "Cruveilhier's submucous venous plexus,"³ which has been overlooked by most authors of works upon anatomy, but is of special interest to us from its liability to great variations and the possibility of its being the starting-point of an angiomatous tumor. Such a one is related by Norris Wolfenden⁴ in the

¹ Transactions of the Pathological Society, 1853-54, p. 123.

² Ibid., vol. xxviii. p. 216.

³ Bimar and Lapeyre, Académie des Sciences, October 31, 1887.

⁴ British Medical Journal, June 11, 1887.

case of a girl, aged eighteen, who complained of "a lump in her throat" whenever she suffered with a cold, but beyond this there were no subjective phenomena. On illumination, the right side of the oro-pharynx was seen to be occupied by a large angioma apparently springing from the posterior and lateral walls, just behind the faucial pillar. In phonation, it extended above to the level of the soft palate; beneath, to below the level of the base of the tongue. It was in appearance knotty, dense, and purple. Tortuous varicose veins were seen on the right side of the uvula and on the right anterior faucial pillar. Owing to the absence of real inconvenience, it was deemed advisable to "let it alone."

A similar tumor, but situated somewhat higher, is related by Guyon,¹ which was attended by profuse nasal hemorrhages. On digital exploration, it bled profusely. The treatment here adopted was electrolysis, which soon arrested the bleeding and produced atrophy of the angioma.

Such growths consist of large, cavernous, vascular spaces, similar to erectile tissue; but the majority of recorded instances present simply dilated arteries or varicose veins. Cresswell Baber² relates the cure of a pulsating vascular elevation in the left salpingo-pharyngeal fold, possibly due to dilatation of the ascending pharyngeal artery. J. W. Farlow³ records five cases of large, visible, pulsating arteries of the pharynx.

Apart from these strictly angiomatous tumors, small "red-currant-like" clusters are often seen, which bleed upon the slightest touch, and by reason of the rich vascular supply merit inclusion in this group.

Of the varicose type a graphic description is quite recently given by Dr. George Croker,⁴ in which the patient, a man, was troubled with an irritating hawking and a mucous discharge from the back of the throat of several years' duration. On examination, a mass of varicose veins was seen to project into the back of the throat like a long, wrinkled black snail or a bunch of blackberries. It seemed to spring from behind the faucial pillars, extending upward into the naso-pharynx and downward as far as the base of the tongue, epiglottis, and right ary-epiglottic fold, to all of which it was attached. The inconvenience to the patient being insignificant, it was decided not to operate in any way.

Treatment.—Notwithstanding that some writers hold that active interference is unnecessary unless the hemorrhage is severe, it must not be overlooked that the patient's life is always in danger from his liability to a sudden and unexpected hemorrhage occurring at a time when help may be least available. The most satisfactory treatment is undoubtedly electrolysis, for it rarely happens that the tumor is sufficiently pedunculated to admit of its inclusion in a snare. When the disease is due to one or two dilated

¹ Société de Chirurgie, January 25, 1873.

² Brighton and Sussex Medico-Chirurgical Society's Meeting, March 3, 1887.

³ Boston Medical and Surgical Journal, March 3, 1887.

⁴ British Medical Journal, March, 1892.

vessels, there is no reason why it should not be treated in the same manner as varix elsewhere,—viz., by ligation and excision. Such a case as the one last quoted was peculiarly suitable for this form of procedure.

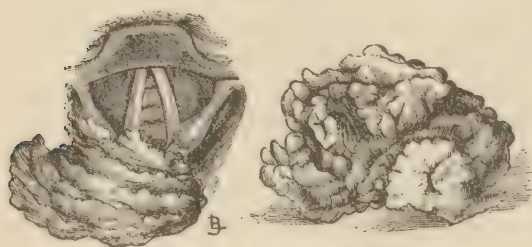
Papillomata of a purely local origin are rarely found behind the faucial isthmus, but irregular ragged elevations may occur in any portion of the pharynx as a result of some inflammatory process, such as syphilis or lupus. The mouth being lined with papillæ, it is not surprising, therefore, to find papillomata very numerous in that situation; but papillæ in the pharynx are so few—the mucous membrane has such an entirely different origin and is of such a distinctive histological character—that papillomata are necessarily less common in this region.

Microscopically, a papilloma consists of elevations of epithelial cells which grow in an upward direction and contain a core of connective tissue and blood-vessels. As a rule, the nuclei do not exhibit indications of great activity. “Nests” or “pearls” are often found, but they are totally unlike those occurring in stratified epitheliomata, for which they may be readily mistaken by the unskilled microscopist. The cells forming a papillary nest are uniform, whilst those of an epithelioma are multiform.

A papilloma of the pharynx must always be looked upon with suspicion, for, although the microscope may indicate benignancy, the after-history may, unhappily, belie the prognosis given on such evidence.

The following case,¹ which occurred in the practice of Sir Morell Mackenzie in 1870, while the writer was associated with him as assistant, illustrates the importance of this caution. Miss H., aged thirty-seven, complained of discomfort during deglutition of about three and a half years' duration. Upon examination, a pale-red growth was seen to occupy the mouth of the œsophagus, which it nearly filled, springing from the mucous membrane of the pharynx, just below the arytenoid cartilages. (Fig. 6.)

FIG. 6.



Papilloma of the pharynx.

In size and contour it very much resembled a peeled walnut, and it was attached by a broad peduncle. After removal by the wire *écraseur*, which was attended with but trifling hemorrhage, it was judged to be a simple papilloma; it weighed seventy-five grains and

measured one and a half inches by three-quarters of an inch. The accompanying figures of the growth *in situ* and after removal were made by the writer. The subsequent history, however, proved either that too sanguine a view of its innocence was taken or that a change took place in its structure,

¹ Transactions of the Pathological Society of London, vol. xxi. p. 54.

for a recurrence speedily happened, malignancy was developed, and the patient died about twelve months after the first operation.

It is but just to quote the following paragraph from the report of the Morbid Growth Committee of the Pathological Society, to which this specimen was referred:

"From a structural point of view we should call the growth a papilloma. The transitional forms between epithelium and sarcomous tissue (growing areolar) in the sub-epithelial portion of the growth throw doubt upon the simplicity of its plan and raise proportionately probabilities of its recurrence."

It should also be stated that, although this case was exhibited at the Pathological Society in 1870 as a papilloma, it is described and figured in the author's later systematic work (1880) as a sarcoma.¹ (Fig. 7.)

FIG. 7.



"SECTION OF PAPILLOMA OF PHARYNX.—aa, epithelium covering papilla; b, sarcous tissue in centre of papilla."

Notwithstanding the serious aspect which the foregoing case assumed, the prognosis of growths under our present consideration, although necessarily guarded from the special peculiarities of the situation, will be, on the whole, favorable, and the treatment should in all cases be removal as close as possible to the base, or even inclusion of that portion of the mucous membrane from which it grows. In all cases a free application of the electric cautery to the base is advisable.

¹ Op cit., p. 350.

Porter¹ records a case successfully treated with chromic acid.

Teratomata and Cysts.—The connection between these tumors is so close and their origins are so obscure that it is deemed expedient to classify them together.

Teratomata are tumors which owe their origin to congenital aberrations, and consist of formed tissues derived from two or three of the germinal layers; they consequently occur in those situations where the several layers are brought into close apposition, either temporarily or permanently. The junction of the neural and dermal epiblasts with the hypoblast of the fore-gut would therefore suggest a likely field for teratomata, and this is fully realized, for the pharynx is rich in growths of this description, and to this fact Bland Sutton² has drawn attention. Tumors containing fully-formed tissues foreign to the part are generally found to involve the upper region. Nevertheless, they do occur even in the middle and the lower pharynx.

The commonest form of teratoma is a polypoid mass covered with hair and containing either bone or cartilage. Such a one is reported by Phineas Abraham;³ another, by Hale White,⁴ contained cartilage and skin with its glands and hairs. Eliot⁵ describes a tumor the size of a walnut, which grew into the pharynx from the left half of the velum palati and contained pieces of bone. The patient died from hemorrhage subsequently to its evacuation. Otto⁶ describes a congenital hairy polypus growing from the posterior aspect of the velum, and refers to three others of a similar character. This author states that in shape they were always pyriform.

Difficulty in diagnosis of these growths is rare, their progress is generally benign, and treatment by enucleation or snare is mostly satisfactory, but careful observation against recurrence must always be maintained for some time afterwards.

Cysts containing fluid rarely reach any great size in this region, and they mostly occur as small mucocoeles or retention cysts in the posterior and lateral walls. They contain a glairy fluid, and when opened and well scraped with a curette seldom cause any further trouble. Porter reports⁷ a case in which the cyst projected three-eighths of an inch from the posterior pharyngeal wall: it was opened and cauterized with a solution of perchloride of iron. Raugé⁸ describes a variety in which the cysts are situated in the submucous tissue, and, although they are often difficult to see, he considers them to be of frequent occurrence. They are generally about the size of a cherry and sessile. They are of interest from the fact that many reflex neuroses—*e.g.*, asthma, migraine, etc.—may be due to their presence.

¹ Transactions of the International Medical Congress, Washington, 1887.

² Introduction to General Pathology, London, Churchill, 1886.

³ Journal of Anatomy and Physiology, vol. xv. p. 244.

⁴ Transactions of the Pathological Society of London, vol. xxxii. p. 201.

⁵ Transactions of the American Laryngological Association, 1888.

⁶ Virchow's Archiv, Bd. cxv. S. 272.

⁷ International Medical Congress, Washington, 1887.

⁸ Lyon Médical, 1889.

MALIGNANT GROWTHS.

The lower portion of the pharynx is more often the seat of malignant neoplasms than the superior; but there is difficulty at times in actually determining the exact point of origin, since while many growths which present respiratory symptoms may have commenced in the pharynx and invaded the larynx, there are, although not so many, others which have commenced in the larynx and have spread thence towards the pharynx. The greater tendency to extension from the pharynx is doubtless due to the lower resistance offered by the looser tissues of that region than by the denser structure of the laryngeal cartilages. As elsewhere, the sarcomata are found to be more common in early life, whilst epitheliomata more frequently arise after forty, but examples of the more slowly growing sarcomata may occur even in advanced life. Of their comparative malignancy, it has been the custom to consider the so-called carcinomatous group as being the more fatal of the two, but this opinion was based upon an imperfect knowledge of their structure and origin, for pathological research of recent years has demonstrated that the sarcomata are equally malignant, especially when they occur in the young subject. This is not surprising, for in early life the mesoblastic tissues are particularly productive, whilst the epiblastic and hypoblastic become more active with the advance of age, —*e.g.*, the mammary gland with its adenomatous and carcinomatous proclivities.

With regard to their point of origin, the mucous membrane of the posterior wall of the cricoid cartilage would appear to be a special point of predilection for epitheliomata, whilst the posterior and lateral walls are more usually the starting-points of the sarcomata.

As to the causes we can again only conjecture: it is well accepted that sarcomata of the extremities, etc., may originate from traumatism, and this may possibly hold good in the pharynx. The writer has recorded one such case.¹ Epitheliomata are more likely to occur where there is irritation, and to this no organ is more liable than the pharynx: hence the frequency of this form of growth at the points of the greatest resistance and friction.

Sarcomata are tumors composed of embryonic connective tissue which persistently retains its elementary characters. The line of division between sarcomatous growth and that of simple repair or scar-tissue is difficult to define: hence the great dependence which must be placed, in this class of neoplasms, upon the clinical rather than upon the histological evidence for the purposes of diagnosis and prognosis.

Round-Cell Sarcoma.—This variety grows very rapidly, usually reaching an enormous size and being accompanied with deposits elsewhere, so that it possesses a "general" malignancy. It occurs in young people, is extremely soft in consistence, often polypoid in appearance, and has a great tendency

¹ Op. cit., p. 482.

towards ulceration. Microscopically, it consists of small or large cells with reticular nuclei, embedded in a more or less granular matrix.

The following case is typical of this form of growth.

A youth, aged eighteen, was admitted into the Nottingham Hospital in 1872, under Mr. Littlewood, for a growth in his pharynx of six weeks' duration. The tumor was said to have started from the right tonsil, and grew so quickly that death occurred from exhaustion in nine weeks. The specimen, which is shown in the Museum of the Royal College of Surgeons, London,¹ as a vertical section of the head, well demonstrates the attachments and dimensions of the neoplasm, which consists of a large, soft, flocculent tumor occupying the greater part of the pharynx, encroaching upon the larynx, and spreading into the adjacent muscles and tissues behind the jaw. The growth of this tumor was rapid, even for a sarcoma, and it is a good illustration of the intense malignity of this form of neoplasm when occurring in early life.

Diagnosis.—This may at first be difficult, but the rapid asthenic course soon indicates the nature of the malady, though at an early date a round-cell sarcoma might not unreasonably be confused with retro-pharyngeal abscess or phlegmonous pharyngitis.

Treatment.—Complete enucleation, even early, is extremely difficult, even though it may be encapsuled, and is generally impossible. If, indeed, removal is effected, recurrence with deposit elsewhere is so certain to follow that a "masterly inactivity" may be generally recommended as the most humane course. Electrolysis is contra-indicated, as it only "stirs up the fire."

Spindle-Cell Sarcomata.—This group of tumors generally shows less malignancy than the round-cell variety. In the pharynx they usually occur at a somewhat later period of life,—that is, towards middle age.

They are firm in consistence, often pedunculated, of a much slower growth than the round cell, and do not tend to ulcerate. They sometimes spring from the lateral walls of the pharynx, as in a case to be presently related, but more frequently from the posterior wall, as in an example carefully recorded by Knight,² and in others collected by this observer in the same article. When removed they are less likely to return than the round-cell variety, being usually "shelled out" of their capsules, but if snared there is but little hope of permanent disappearance. Whatever the operation, it is advisable to perform a preliminary tracheotomy. When recurrence does follow, it is, as a rule, only local, for there is but little tendency to secondary development. Microscopically, the growth consists of spindle-shaped cells with elongated nuclei embedded in a somewhat scanty matrix.

An instructive case was under treatment at the Central London Throat, Nose, and Ear Hospital by the writer's colleague, Dr. Orwin, in June, 1891.

¹ No. 2283.

² Transactions of the American Laryngological Association, 1879, p. 203.

The patient, a woman aged thirty-three, applied on account of "difficulty in speaking and stifling sensations in her throat" of three years' duration. Six years previously she had noticed a hard swelling behind the angle of the left mandible, which was thought to be an enlarged gland; but three years afterwards, upon losing her voice, she consulted a specialist in Montreal, who, diagnosing the tumor as cystic, punctured the mass, without however, releasing any fluid. This was followed by much pain, and, having rapidly emaciated, she came to England for further treatment.

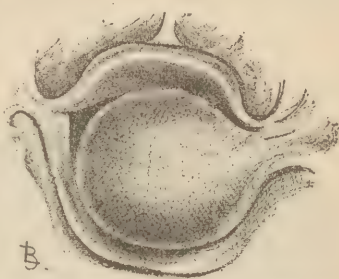
On admission she bore all the indications of marasmus, but was not in any great pain; she could swallow easily, but could breathe comfortably only when lying on her left side. Examination revealed a large mass springing from the left pharyngeal wall (Fig. 8), below and behind the posterior faucial pillar, and hiding nearly the whole of the larynx except a small portion of the epiglottis. It was about the size of a walnut, pale, smooth, firm, freely movable, and attached by a thick pedicle. The external mass was connected with the pharyngeal tumor, and was apparently of a similar size and consistence.

On July 11 the greater portion of the pharyngeal growth, weighing fifty-six grains, was removed by a galvanic snare, with very little bleeding. Considerable local congestion and oedema followed, which necessitated tracheotomy, and her condition caused great anxiety; but, complete expansion of the lungs being restored, she soon rallied, and two months afterwards was discharged wearing a pea-valve tube. At the time of writing (April, 1892) her condition is in every way satisfactory, and there are no indications of a recurrence, local or remote. Microscopic examination of the growth proved it to consist of small spindle cells embedded in a scanty matrix and permeated by blood-vessels. At the surface was a well-differentiated capsule.

A case similar to the preceding is shown in Specimen No. 2316, at the Museum of the Royal College of Surgeons, in which a mass measuring one and one-half inches by one inch is seen attached to the posterior pharyngeal wall, which extends nearly as far forward as the epiglottis; but a still better one is Specimen No. 3506 B in the same museum, which is questionably described as a sarcoma of the larynx. In it is seen a mass as large as an orange occupying the whole posterior surface of the arytenoid and cricoid cartilages.

Myxo-Sarcomata.—These are for the most part spindle- or round-cell varieties which have undergone mucoid changes. They usually occur in early middle life, and may be considered to be only locally malignant, for, whilst they may recur after removal, they do not seem to multiply elsewhere.

FIG. 8.



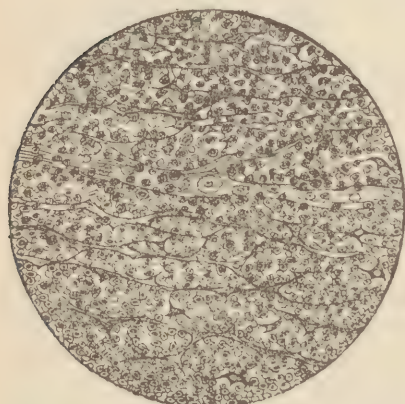
Spindle-cell sarcoma of the pharynx.

Microscopically, they consist of round- or spindle-cells with a delicate stroma of branched corpuseles embedded in a transparent matrix of mucoid substance. These growths are generally polypoid, lobulated, and translucent, and are about the least malignant of the sarcomata.

They usually start in the loose cellular tissue of the lateral walls of the pharynx or in the glosso-epiglottic folds and fossæ. Such an origin is recorded by Morgan.¹ The patient, a man aged forty-nine, complained of dysphagia, and on examination a pedunculated mass was seen springing from the left glosso-epiglottic fossa and the adjacent pharyngeal wall. It was removed by the fingers, and did not recur.

Lympho-sarcomata present themselves as modifications of the round-cell variety, and it is difficult to draw a sharp line between the two. The

FIG. 9.



Lympho-sarcoma.
Obj. $\frac{1}{8}$ oc. 3, $\times 120$.

chief distinctive feature is the presence of a delicate reticulum which encloses the round cells as in a mesh-work. (Fig. 9.)

Lympho-sarcomata occur for the most part in early life, and have a great tendency to burrow among the neighboring structures. Starting most likely from the lymphoid structures of the pharyngeal mucous membrane, they grow and multiply very rapidly. As a rule, they recur after removal.

A specimen (No. 2317) in the Museum of the College of Surgeons of England (Fig. 10) shows the great extent to which the digestive and the respiratory tubes may be encroached upon by the ravages of this class of

FIG. 10.



Lympho-sarcoma of the pharynx and esophagus.

¹ Transactions of the American Laryngological Association, 1883, p. 168.

neoplasm. The walls of the pharynx are seen to be almost entirely occupied by large, flat, lobulated masses which nearly fill its cavity, and which, by pressing forward the arytenoids, have seriously obstructed the larynx. At the upper part of the œsophagus is a round nodule of the same substance which is lodged in a sacculated dilatation of the walls of that canal.

The diagnosis from an ordinary round-cell sarcoma will be based upon the above features. Such a growth may easily be confused with gummatous deposit, as in the case recorded by Schwitzen.¹ Such eminent authorities as Professors Neumann and Kaposi believing that syphilis was present, anti-syphilitic treatment was tried, but without effect. The ulceration extended and reached the larynx. Tracheotomy had to be performed, but the patient died a few days afterwards. The autopsy proved the case to be one of sarcoma of the pharynx and larynx, with metastatic tumors in the peritoneum, spleen, and kidney.

With regard to treatment, the only hope is in early removal before they have had time to multiply. As a constitutional remedy arsenic has received much attention.

Epitheliomata (Carcinomata).—The middle and the lower pharynx are particularly liable to this form of neoplasm, which originates for the most part either from the pharyngeal aspect of the cricoid region or from the posterior wall of the pharynx, both being situations which, as before stated, are specially exposed to friction. The varieties most frequently found are the stratified and the alveolar, which are determined by the nature of the epithelium in which they originate; those commencing in the surface epithelium assuming the “squamous” or “stratified” type, whilst the alveolar have their origin in the gland-tissue or its ducts.

Like epitheliomata elsewhere, these pharyngeal growths manifest themselves at or after middle age. Their development is rapid, they soon ulcerate and become distributed by the lymphatics; and removal, except in the earliest stage, is invariably followed by recurrence, partly from their tendency to invade the surrounding tissues, which increases the difficulty of their complete enucleation, and partly from their great tendency to appear secondarily in the near and distant lymphatic glands.

Diagnosis is rarely difficult, especially when the disease occurs in the cricoid region, for all growths connected with that part must be regarded with great suspicion. At the onset there is always a tendency to hesitate between malignancy and syphilis, especially when combined with a definite specific history; but the results of anti-syphilitic treatment under a short period of observation will soon clear up any doubts as to the exact nature. Important adjuvant aids will be found in the state of the lymphatic glands, the patient's appearance, the discharge of blood-stained, fetid sputum (which often contains structural indications, such as cell-clusters), and, finally, the rapidity of the ulceration and the persistence of recurrent hemorrhage.

¹ K. k. Gesellschaft der Aerzte in Wien, April 12, 1889.

The prognosis is necessarily most grave, death occurring, as a rule, within twelve months, either from starvation, asphyxia, or hemorrhage. The latter cause is not uncommon, three such cases having occurred in the writer's personal clinic. Examples of complete stenosis are well shown in No. 2307, Museum of the Royal College of Surgeons, England, and in No. 2310.

Of the two varieties of pharyngeal epithelioma, the *alveolar* and the *stratified*, the former seems to be the more frequent; it does not appear to be associated with any special region of the pharynx, which is not surprising, since gland-tissue is found in all parts of the pharyngeal mucous membrane.

The *alveolar* variety consists microscopically of spheroidal cells arranged in groups, without any cementing substance, enclosed in an alveolar stroma formed by similar cells more closely packed together. (Fig. 11.) Blood-vessels with very thin walls are numerous, and small-cell tissue generally precedes the epithelial tissue as it becomes lost in the normal tissues which it attacks.

FIG. 11.



Alveolar epithelioma.
Obj. $\frac{1}{6}$, oc. 8, $\times 130$.

A recent example of this form under the writer's care is that of a man, aged sixty-one, who was admitted to the Central London Throat, Nose, and Ear Hospital in July, 1891, for dysphagia and odynphagia of six months' and six weeks' duration respectively. He was greatly emaciated, and on examination a large mass was seen to nearly fill the lower pharynx, apparently springing from its posterior wall. On palpation it was found to be hard and painless and continuous with a firm swelling behind the angle of the lower jaw, moving with it during deglutition. There was also a deposit in the left side of the tongue. Four days after admission deglutition became impossible, and, rapidly emaciating, the patient died from suffocation and asthenia twelve days later, less than seven months from the commencement of his symptoms.

The autopsy revealed an ulcerated mass occupying the posterior wall of the pharynx for two inches above and below the level of the cricoid cartilage, which structure and three upper rings of the trachea were distorted by the pressure of the tumor; the growth also extended upward to the right posterior faucial pillar, where it ceased abruptly. An ulcerated mass occupied the greater portion of the left side of the tongue, and there were found secondary deposits in the pleuræ and mediastinal glands.

The microscope proved that all the cancerous tissue was of the alveolar type.

There was no difficulty in the diagnosis of this case, and its chief feature

of interest is that it illustrates the extreme rapidity with which this type of epithelioma may grow and the widely-spread distribution of its secondary deposits.

Bristowe¹ relates the history of a similar growth in a woman, aged forty-eight, which subsequently involved the larynx, tonsils, and tongue, with secondary deposits in the lungs and mediastina. This also commenced in the posterior wall of the lower pharynx, which region, although a frequent primary site, is far less often involved than the mucous membrane behind the cricoid cartilage. An example of this last was exhibited by the writer at the Pathological Society of London,² in the person of a woman, aged sixty-two, and is also related and depicted in his systematic work.³

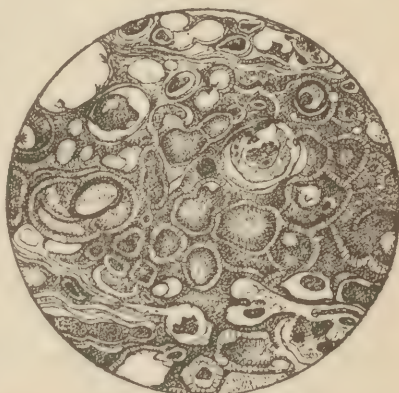
The *stratified* form frequently starts from the epiglottis and involves the pharynx secondarily, although it may often start in the surface epithelium of the pharynx itself.

Microscopically, the growth is found to consist of masses of epithelial cells (without any apparent matrix) which grow downward into the mucous membrane, forming columnar, finger-like processes, giving in transverse section the characteristic "nest" appearance. With these columns small-cell inflammatory tissue is always found. As in the laryngeal epithelioma, the cells present a beautiful "crenation" of their outer border, constituting the "prickle" cells. (Fig. 12.)

This form, although very rapid in its growth, is perhaps more amenable to removal in its early stage than is the alveolar, but it is impossible to distinguish between the two with any degree of certainty without a microscopic examination: hence the value of removal of a fragment for this purpose before proceeding to attempts at eradication.

Gilbert Smith⁴ also relates a case which commenced in this region, and his report draws attention to what he considers the great preference which epitheliomata show towards growing in the direction of the pharynx rather than towards an invasion of the larynx; this occurs, in his estimation, sufficiently often to justify the establishment of a rule; but exceptions to it are far too numerous to warrant dogmatism on the point. Two specimens⁵

FIG. 12.



Prickle-cell epithelioma.
Obj. $\frac{1}{6}$, oc. 3, $\times 130$.

¹ Transactions of the Pathological Society of London, vol. xxii.

² Ibid., vol. xxix. p. 250.

³ Op. cit., p. 480.

⁴ Transactions of the Pathological Society of London, vol. xxxi. p. 102.

⁵ Nos. 2310 and 2320, Museum of the Royal College of Surgeons, England.

in the Museum of the Royal College of Surgeons show the cricoid cartilages as pierced by the growth in each instance, and the author has himself recorded, in common with other observers, several cases which negative the contention of this writer. A somewhat rare situation for a primary epithelioma is the posterior aspect of the soft palate, but the Museum of the College of Surgeons, England, supplies an example in Specimen No. 2284.¹

To growths which are primarily epitheliomatous must be added those which may have become malignant secondarily,—*e.g.*, by the conversion of an apparently simple papilloma, an example of which has been already recorded. (See Papillomata.)

Growths due to mere inflammatory or constitutional causes, such as *syphilis* or *lupus*, need only be alluded to, as their fuller consideration will be comprehended in the portion of this work which relates to those diseases. They are generally papillomatous in nature, as already mentioned in the discussion of that kind of growth.

PART II.

CONGENITAL MALFORMATIONS AND NEW GROWTHS OF THE LARYNX.

Deviations from the normal conformation of the larynx may be considered under two main divisions:

I. Congenital, or those which originate *in utero*.

II. Those occurring as a result of disease subsequently to birth.

Congenital aberrations may be conveniently subdivided into three classes:

(a) stenosis, (b) dilatations or pouches, (c) hypertrophies or growths.

Concerning the etiology of all of these our knowledge is no less limited in this situation than it is in the causes of developmental anomalies elsewhere; still it must be admitted that in their non-conformity with the laws of development we must first take note of a parental "taint" as an important or at least as a ponderable quantity. Let it be granted that teratological curiosities are produced by reputably healthy parents; it must be conceded that a specific dyscrasia plays a prominent rôle in the inducement of many of the laryngeal anomalies which show themselves in the early life of their offspring.

(a) STENOSIS.

A narrowing of the larynx may be due to an arrest in the development of the whole organ, constituting a "diminutive" larynx, such as is so frequently found in monorchids and in those with other imperfections of the genital tract,² or to an incomplete formation of portions only of the vocal

¹ See also Transactions of the Pathological Society of London, vol. xxxvi. p. 397.

² Dupuytren, Bulletin de la Société Philosophique, tome ii. p. 195.

apparatus, such as the thyroid cartilage.¹ The larynx, trachea, bronchi, and lungs are formed together by an outgrowth from the ventral aspect of the foregut, and it is, therefore, rare to find a developmental abnormality involving one part without the others, for in monsters whose lungs are absent the larynx is also wanting, or at the most it is only rudimentary. Any marked degree of laryngeal dwarfing, or stenosis, is therefore incompatible with full functional activity of the lungs.²

The form of stenosis most frequently met with is that due to bands or webs, stretching across the glottis, or as a septum or diaphragm perforated more or less centrally. These bands occur for the most part in the *anterior commissure*, less often about the centre, and most rarely of all in the interarytenoid region; for this situation is affected by a totally different anomaly, viz., a cleft which may extend through the cricoid cartilage and be associated with a similar condition of the palate and epiglottis.³

The congenital origin of that form which is found as a bridge across the centre of the glottis must be considered doubtful, especially when it is only recognized in adolescence or adult life.⁴

The web usually connects the vocal cords, sometimes also the ventricular bands; it is of a pale color, and apart from its position cannot be distinguished from the cords themselves; it is usually thin and readily torn, but may sometimes be very resilient; qualities which are in striking contrast with bands which are the result of an ordinary inflammatory process. This view receives confirmatory evidence when there is a history of a similar anomaly in other members of the family⁵ unattended with a history of inflammatory dysphonia during childhood. Seifert reports such an example, in which the father, a son, and two daughters were the subjects of congenital webs. A slightly incomplete separation of the vocal cords in front is by no means rare, and is not necessarily associated with any errors of phonation; but this condition in an exaggerated form may readily constitute a semilunar band or web, and when recognized in early life, admits of a congenital interpretation only.

Congenital stenoses may exist for many years without the manifestation of any symptoms suggestive of a laryngeal deformity, as in (Case I.) a case under the author's care at the Central Throat, Nose, and Ear Hospital, that of a man, aged thirty-one, who was admitted in May, 1888, complaining of painful deglutition and alteration of the voice. He gave no history of syphilis or throat trouble, but had always been delicate in health, and his voice from infancy always weak. About eighteen months before his admission he noticed, after preaching in the open air, a

¹ See Case II. of Stenosis and Case II. of Papillomata.

² Roederer, *Comm. Soc. Gott.*, Bd. iv. S. 136.

³ *Lancet*, January 10, 1851.

⁴ Schrötter, *Vorlesungen über die Krankheiten des Kehlkopfes*, pp. 23-40, Wien, 1889.

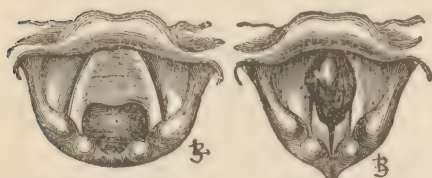
⁵ *Berliner Klinische Wochenschrift*, 1889, No. 2.

more distinct change in the quality of his voice, it becoming more puerile; this state had persisted in a varying degree ever since. Laryngoscopic examination revealed a well-formed semilunar web occupying a considerable portion of the *anterior commissure* and connecting the vocal cords, which were highly injected, as also was the rest of the larynx. There was further well-marked granular pharyngitis. The web was slit by the author's cutting dilator, and four days later he was discharged as an out-patient with a perfectly normal larynx. Patency was maintained by the periodical passage of a Schrötter tube for some weeks. This case was undoubtedly one of a congenital nature, and in all probability would never have come under notice but for the vocal abuse to which the patient exposed himself by open-air preaching.

CASE II.—Morell Mackenzie¹ records an interesting case of congenital papillomatous web which united the vocal cords and was accountable for aphonia from birth, but which was discovered only by means of the laryngoscope when the patient, an otherwise healthy young lady, had arrived at the age of twenty-three years. The form of the web on inspiration and its appearance on vocalization are illustrated by the annexed

FIG. 13.

FIG. 14.



Congenital web of the larynx. (Morell Mackenzie.)

drawings (Figs. 13 and 14), which were made at the time by the writer, who had also personal knowledge of all the circumstances. The web was removed at three sittings by means of Mackenzie's cutting forceps, and the patient then for the first time spoke in a clear and natural voice. The tissues re-

moved were found to be composed of a stroma of connective tissue, the fibrous bands of which interlaced and crossed one another in various directions; papillary outgrowths irregularly lobulated were also found in the connective tissue.

CASE III.—Another instance occurring in the author's practice, which, though similar in its anatomy, presented very different clinical features, was that of a little girl, aged four years, who was admitted to the Central London Throat, Nose, and Ear Hospital on November 19, 1888, suffering with dyspnoea, dysphagia, and cough. The history showed that she had "never had a proper voice," but always enjoyed good health and was "quick" at school. Since birth she had snored loudly, and her breathing had at all times been short and difficult. On examination her tonsils were found to be greatly enlarged, and the laryngoscope revealed a well-marked band in the *anterior commissure*, similar in color to that of the vocal cords, which were somewhat pink. Her chest expansion was very defective. The voice was reduced to a mere whisper, and she could only swallow

¹ Transactions of the Pathological Society, 1874, vol. xxv. p. 35.

semi-solid food, since attempts to take liquids were followed by choking and regurgitation. Seven days after admission she was seized with a sudden and severe attack of dyspnœa, so that it was deemed advisable to "intubate." This was followed by complete relief and free chest expansion. Three weeks later, on examination, it was observed that the laryngeal web had entirely disappeared, its position being simply indicated by a slight ulceration of each vocal cord. Fourteen days later she was discharged, having been relieved of all her serious symptoms, but with no power of phonation. At the time of writing (May, 1892) the child now speaks in a clear, firm, but somewhat low-toned voice. The larynx is perfectly free.

That variety which occurs as a perforated diaphragm is extremely rare, for such a severe stenosis cannot be attended with complete expansion of the lungs.

A careful consideration of the patient's history, in conjunction with the variations in the physical phenomena presented, will afford abundant evidence for the diagnosis of congenital stenosis from atresia due to some inflammatory process.

Treatment consists in first removing all obstructions to perfect breathing, in the upper passages, such as enlarged tonsils, adenoids, nasal polypi, etc., after which attention should be directed to the larynx itself. As these congenital bands are usually very thin, no elaborate surgical measures are demanded. The careful introduction of an O'Dwyer's tube may often prove quite sufficient, but failing this, as may be the case when the web is dense or resilient, a cutting instrument, such as the author's cutting dilator, will be necessary. After incision it is advisable that a tube should be worn for several days or be passed periodically. The surgeon must be always prepared in these cases for the possibility of an immediate tracheotomy, and indeed this measure is called for in some cases as a preliminary safeguard.

In the absence of any serious symptom the advisability of surgical interference has been questioned; but, considering that with a narrowed glottis the patient's life may be at any moment threatened, the author does not share the opinion expressed by Morell Mackenzie that "as a rule deformities of the larynx do not come within the province of treatment."¹

(b) DILATATIONS OR POUCHES.

This deformity is extremely rare in man, notwithstanding its frequency in the lower animals; and an exhaustive search has been rewarded by the discovery of only one genuine case under the care of Madelung.² This occurred as a median dilatation in the shape of a pouch, or laryngocele, which was situated in front of the thyroid angle, and communicated with the interior of the larynx at the anterior commissure by means of a small

¹ Manual of Diseases of the Throat and Nose, 1880, p. 497.

² Langenbeck's Archives of Clinical Surgery, Band xl. p. 630.

aperture. Its rarity merits a somewhat detailed report. The patient was a man, aged twenty, who noticed, without previous symptoms, a tumor on the fore part of the neck in the thyroid region, which disappeared under pressure and refilled very slowly. On cutting down, the tumor was found to be formed of two sacs freely communicating with each other, the bilobulated condition being due to the mechanical action of the sterno-thyroid muscles, which compressed the lateral walls of the sac. The anterior portion was larger than the posterior.

The hinder compartment communicated with the interior of the larynx through a small opening between the two laminae of the thyroid cartilage. The sac was removed, and it was found to be formed internally of mucous membrane and externally of muscular tissue. The mucous membrane was found to be tubercular. The patient recovered from the operation. Laryngoscopical examination made previous to the treatment had revealed a typical sub-glottic laryngitis hypertrophica. This was not materially modified by the operation, the voice still remaining hoarse. There were no signs during life of intra-thoracic disease, but the patient died suddenly, somewhat later, and apparently from an attack of suffocation, having spoken in a perfectly clear voice immediately before death. No autopsy was permitted.

Of three hypotheses considered, Madelung accepts as the most probable that of a congenital opening in the anterior portion of the thyroid cartilage with subsequent hernia of the mucous membrane and dilatation of the pre-thyroid muscles with ultimate tuberculous degeneration of the mucous membrane due to imperfect ventilation of the sac. The sac, through pressure carried on by the sterno-thyroid and sterno-hyoid muscles, had produced a malformation of the larynx, caused by an inward bending of the superior portion of the thyroid cartilage. The case is unique, though a somewhat analogous observation is accredited to Hutchinson.

Bland Sutton¹ considers such a condition as a dilatation of Morgagni's pouch, and relates cases of cervical cysts which he regards as being probably lateral diverticula from the larynx or trachea.

On the whole, this anomaly is so rare that it may reasonably be placed outside the limits of laryngeal surgery and considered more as a morphological curiosity, only of interest for the student of transcendental anatomy.

(c) HYPERTROPHIES OR GROWTHS.

The examples of this group are restricted to the papillomatous variety, and are neither few nor of infrequent occurrence.

They consist of ordinary papillomata or soft warts, occurring singly or in clusters, for the most part in the anterior commissure, at the level of, and often springing from, the true vocal cords. As in the case already quoted from Morell Mackenzie, they may be associated with a congenital web. Microscopically, congenital papillomata are local hypertrophies of the

¹ Introduction to General Pathology, 1886, p. 233.

mucous membrane, covered with stratified epithelium which encloses a "core" of connective tissue (Fig. 15) and blood-vessels, with portions of gland-substance near the base: in fact, they are *simple elevations of the normal tissue*. This is a point of some value, as it serves to distinguish these congenital growths from irritative papillomata which may arise from an inflammatory process occurring after birth, and to be described later on.

The etiology of congenital growths affords a wide field for speculation, and many are the theories which have been formulated as to their origin. That they represent a localized redundancy of tissue may be quite true, but there must be some predisposing cause for their appearance, apart from any specific or tuberculous diathesis. A peculiar "papillomatous dyscrasia" has been suggested: perhaps this with structural defects elsewhere in the respiratory passages may not be entirely irresponsible. In a paper read before the British Laryngological and Rhinological Association, November, 1890,¹ the writer pointed out the possibility of hypertrophy of

the pharyngeal tonsil being an etiological factor in the persistence of laryngeal papillomata of children, and a case (Case IV., sent to the writer by Dr. McDonagh, of Toronto) was related in which laryngeal papillomata (Fig. 16) continued to recur after removal, until the adenoids were scraped, when the child (then aged six and a half years) enjoyed immediate relief, and the growths have not since recurred. Another case of a similar nature was on this occasion alluded to as confirmatory of the author's contention.



Recurrent papillomata of larynx of congenital origin.

FIG. 15.



Congenital papilloma of larynx.
Obj. 3, oc. No. 3.

Let it be granted that papillomata are present at birth,—a point to be presently considered more fully,—their continuance is undoubtedly assured by mouth-breathing, one of the chief causes of which is the presence of adenoids, while in other cases non-congenital, this same mouth-breathing may lead to laryngeal hyperæmia and irritation, and be responsible for the actual origin of a neoplasm, as was recorded on the same occasion in the

¹ Journal of Laryngology, vol. v., 1891, p. 21.

case of a child aged eleven. Although congenital papillomata often occur in the children of parents in whom there is not even a suspicion of syphilis or tubercle, it may be that these dyscrasæ are predisponent factors in not a few instances.

Recognition of congenital growths is by no means difficult: defective phonation, which is the prominent symptom, at once directs attention to the larynx. Sometimes other signs of laryngeal irritation are also present, such as a persistent metallic cough, or occasional attacks of spasmodic dyspnoea.

A case illustrating¹ these symptoms (Case V.) is that of a child, aged three years, who was brought as an out-patient to the Central London Throat, Nose, and Ear Hospital, under the author's care, and was admitted three days later.

Since birth the child had never had any voice, and had always suffered more or less from difficulty of breathing, which had increased in the last six weeks. He was reported to sleep with mouth widely open, and to breathe loudly. He had occasional cough, which was aphonic in character. The child was also reported to suffer slightly from headache.

He was well nourished, healthy-looking, but with a voice absolutely aphonic. During physical examination he emitted a faint and almost toneless cry. The respiration was labored, and there was slight in-sucking of the lower costæ on both sides. Inspiration also was loudly stridulous. Air entered each lung equally, but the chest was by no means fully expanded. The fauces were congested, and with the laryngoscope the glottis was seen to be filled with growths. A No. 3 O'Dwyer's intubation tube was introduced experimentally, and was followed by immediate benefit to the breathing, but, the mother not desiring to leave the child, the tube was withdrawn after a short time. The day following admission a serious increase in the dyspnoea occurred, and intubation was again performed. This was followed by hemorrhage, and the tube was immediately withdrawn. The boy became speedily asphyxiated, but was relieved by extending the head backward. However, the dyspnoea returning as soon as the normal position was resumed, tracheotomy was promptly performed, and vitality re-established by artificial respiration. Until the afternoon of the following day, the patient seemed fairly comfortable, with the exception that his breathing was rather jerky. About 5 P.M.—that is, twenty-four hours after the tracheotomy—a burst of hemorrhage took place from the tube, which was withdrawn, and the wound kept open by means of a dilator. At 6 P.M. the tube was again introduced, and 7.30 the hemorrhage recurred; the same measures were repeated, but with less success; respiration steadily deteriorated, and the child died about forty hours after the operation, of asphyxia. At the autopsy, made twelve hours after death, the tracheotomy wound was of healthy appearance, and there were no signs of any external hemorrhage. On opening the larynx, the laryngeal aspect of the epiglott-

¹ Transactions of the Pathological Society, vol. xl., 1889, p. 34.

tis was seen to be abnormally red, and slightly granular. Two minute cysts, about the size of a pin's head, were also visible. On each vocal cord, and on each ventricular band, there was a group of warty growths. There was an abraded and hemorrhagic point on the right cord, whence the bleeding had evidently come at the second introduction of the intubation tube. The faucial tonsils were somewhat enlarged and the naso-pharynx was occupied by adenoids.

Microscopic examination demonstrated that the laryngeal growths were of a truly papillomatous structure. Both lungs were very much collapsed, and were not larger than those of an infant at term. The edges and substance for some distance inward were in a carnified condition (atelectasis). At the apex of each lung, and in the lowest lobe of the right, were large areas, three in all, of pulmonary hemorrhage. These were probably the sources of the bleeding which took place subsequently to the tracheotomy.

This case, besides presenting an instance of congenital papillomatous growth in the larynx, is of great clinical interest, in the fact that it illustrates, so far as the writer can ascertain, a hitherto unrecorded source of danger from tracheotomy in an infant, the subject of congenital obstruction to laryngeal respiration. There can be little doubt that the increased volume of air admitted by means of the tracheotomy tube led to rupture of lung-tissue which had never been expanded to its normal capacity. It also suggests that tubage is contra-indicated in cases of laryngeal new growths.

CASE VI.—Another interesting case is that of a girl, L. W., aged eight, who came under the author's hospital care in August, 1889. She complained of "difficult breathing" of four months' duration. Previously she had not shown any indications whatever of laryngeal mischief, with the exception of a slight weakness of the voice. She had neither adenoids nor enlarged tonsils. The author leaving home, she was transferred to the care of Dr. Dundas Grant, who at different times removed as many as twenty portions of growth, leaving the larynx apparently clear, but at varying intervals the growths persistently reappeared till within six months ago, since which date she has been quite free. At the time of writing she has a voice of remarkably good quality and the larynx is perfectly normal.

These cases, selected from a great number, are sufficient to illustrate the different behavior of congenital papillomata. In Cases IV. and V. the recurrence was doubtless due to nasal obstruction, but in Case VI. there was no such cause, and it is reasonable to attribute the persistence to a partial removal, whilst their permanent disappearance coincided with a complete enucleation. That the cases originated *in utero* there can be no doubt, and this view is based upon four grounds, namely: (1) the history of occasional symptoms of laryngeal irritation from birth; (2) peculiarities in phonation dating from birth; (3) general indications of imperfect expansion of the lungs; (4) absence of any constitutional dyscrasia.

The purely congenital nature of laryngeal growths, while admitted by

Morell Mackenzie¹ to be probable, was held by him unproved in 1871, he stating "that there is not a single cure on record where a still-born child has been found to have a laryngeal growth, nor has such a growth been found to exist within the first month or two of infant life." Indisputable evidence has since been afforded which must be held to have solved all doubts on this point; two cases in the newly-born, by Dufour, and five by Johnson (of Chicago),² being quoted by Desvernine³ as an appendix to an excellent observation of his own. This case was that of a child, aged seven, in whose larynx were seven new growths, absolutely independent of one another. The operation of tracheotomy was performed high up and the tumors were removed with Mackenzie's forceps, but the author, having ascertained the existence of a sub-glottic growth, performed thyrotomy, removed the tumor with the curette, and a complete cure resulted.

The violent and fatal hemorrhage in Case V. is a complication which, notwithstanding its rarity, must be considered as an important indication, in the threefold relation of diagnosis, prognosis, and therapeusis.

Treatment of these cases may be generally divided into four parts: (1) the removal of all obstructions to breathing in the upper passages, *e.g.*, adenoids, enlarged tonsils, etc.; (2) the application of astringents and solvents; (3) that of escharotics; and (4) instrumental.

The importance of the first has been already referred to; the second the author considers to be possessed of no practical value, and as a measure that should be employed only as a palliative or when the friends of the patient refuse to submit to a more rational proceeding. The application of escharotics must be unhesitatingly condemned, since it is not only dangerous to life but is liable to stimulate the papillomata to further growth.

Although papillomata often disappear in other situations when all sources of irritation are removed, it rarely happens that such a satisfactory result follows in the case of the larynx; still there can be no harm in waiting for a few weeks and watching for any diminution of the growths after tonsilotomy or the removal of adenoids.

Max Thorner⁴ has lately reported an interesting case of a child, three and a half years of age, in whom atrophy of a laryngeal growth occurred after treatment of an intercurrent catarrhal inflammation, and without either attempt at ablation or the performance of a tracheotomy.

Beyond the question of eradication by endo-laryngeal measures, already sufficiently considered, the question of performing a tracheotomy for the purpose of giving physiological rest and thereby promoting spontaneous

¹ Essay on Growths in the Larynx, etc., London, 1871, p. 14.

² Transactions of the American Laryngological Association, 1883. In the discussion following Dr. Johnson's paper, Dr. J. O. Roe and Dr. Major and Dr. Duncan each reported two cases, and altogether the evidence was very strongly in favor of congenital growths being much more frequent than has been generally supposed.

³ Annales des Maladies du Larynx, etc., Paris, 1890, p. 240.

⁴ Archives Internationales de Laryngologie, etc., tome li., No. 3, p. 150, Paris, 1892.

cure is one which has of late assumed some prominence. This procedure is undoubtedly calculated to be of especial service in the very young, and presumably in the congenital form. Nevertheless the warning engendered by the second case here related, as to a possibly too rapid expansion of an undeveloped lung, is always to be borne in mind.

NON-CONGENITAL MALFORMATIONS AND NEOPLASMS OF THE LARYNX.

- I. Stenosis.
- II. Eversion of the ventricle.
- III. Neoplasms.
 - A. Innocent.
 - B. Malignant.

I. STENOSIS.

Definition.—A chronic or persistent narrowing of the laryngeal aperture.

This may be either (a) traumatic or (b) constitutional.

The term stenosis may appear at first sight somewhat ambiguous, since nearly every deviation from the normal in this particular region is likely to obstruct the passage of air, in a greater or less degree, but the preceding definition and classification will sufficiently indicate the applications of the term.

(a) *Traumatic stenosis* may consist of either a redundancy of healing tissue, or of a deformity of the laryngeal structures due to cicatricial contractions. Sir Charles Bell¹ relates a case in which exuberant granulations, completely filling the larynx, followed some months after a penknife wound of that organ in a girl; death resulted from asphyxia. More often the narrowing is manifested in the shape of a dense cicatricial web or band, such as is found after injuries by cut throat and the swallowing of hot or caustic fluids. With these cases there is often some chronic perichondritis which adds to the vital risk.

The *prognosis* is always grave, for although the patient's life may not be actually endangered, the vocal function is invariably modified according to the position and extent of the cicatricial tissue. Two complications must always be watched for,—viz., a further contraction of the scar-tissue, and the great liability to an acute inflammatory swelling occurring in a larynx the lumen of which has been already diminished by cicatrization.

The *treatment* will vary according to the degree of the stenosis and the density or resiliency of the bands. Whenever the breathing-space is seriously limited, the patient should be kept under close observation, or the trachea should be opened and a pea-valve tube be worn, with the occasional passage of laryngeal tubes or bougies. But attempts at dilatation or cutting must not be undertaken indiscriminately, since irritation of the

¹ Surgical Observations, vol. i. p. 45, London, 1816.

scar-tissue may only stimulate it to further development. When observation proves that the cicatrization is quiescent and the stenosis is not great, the author's cutting dilator may be used with advantage, this to be followed by the introduction of an O'Dwyer's tube for a few hours daily. But if the membrane be extensive, Schrötter's method of excising it by knife or by electro-cautery may be adopted, with the subsequent application of bougies. But neither this nor any other operation should be lightly undertaken, nor without the precautions of a preliminary tracheotomy.

In the event of endo-laryngeal measures failing, thyrotomy might be adopted as a last resource, though the results of this operation on the voice are decidedly discouraging, and even as to respiration, Morell Mackenzie¹ showed that in forty per cent. of the cases dyspnoea was persistent.

Absolute vocal rest till the wound is firmly united is a *sine qua non* of after-treatment.

(b) *Stenosis arising from particular dyscrasie (constitutional).*

Syphilis.—In the larynx, as elsewhere, the deformities due to this disease, in its passive form, are protean in their varieties; no portion of the vocal apparatus being exempt from cicatricial deposit, the result of either secondary or tertiary ulceration.

Three chief forms are met with: (1) chronic œdema; (2) cicatricial narrowing or webs; (3) hyperplastic or papillary outgrowths.

Œdema is always present more or less in every form of syphilitic lesion. It is liable to sudden exacerbations, especially in children the subjects of an inherited dyscrasia, even when the disease is apparently quiescent. The suddenness of the onset and the severity of the stenosis may readily lead to a diagnosis of croup, but the clinical aspects, with a careful attention to the family history, will afford sufficient evidence for differentiation. Several examples illustrative of this statement have occurred in the writer's clinique: one, that of a child aged eighteen months, was admitted into hospital suffering with acute dyspnoea, so severe that tracheotomy was resorted to; the rest afforded by this operation combined with a mercurial treatment soon restored the little patient to health. The history was clearly specific, although there were no indications of such a disease on the child's body. Infantile cases, when correctly diagnosed, for the most part speedily recover under the administration of mercurial and of ordinary analeptic remedies.

The commonest of all forms of syphilitic stenosis is that of cicatricial webs or adhesions which are of varying thickness and surface smoothness. These webs most frequently connect the vocal cords and ventricular bands, but may occur in other situations, as shown in illustrations from the author's systematic work, for instance in one² in which the epiglottis is bound down by cicatricial adhesions. Figs. 17 and 18,³ reproduced from this volume, are typical examples of the web form, of which numerous cases

¹ British Medical Journal, May, 1873.

² The Throat and Nose and their Diseases, 1890, p. 388; Fig. 3.

³ Op. cit., third edition, Figs. 65 and 66, Plate 7.

are related by Elsberg,¹ Schrötter,² and others. A graphic illustration, to which allusion has been previously made, of the extraordinary eccentricity

FIG. 17.

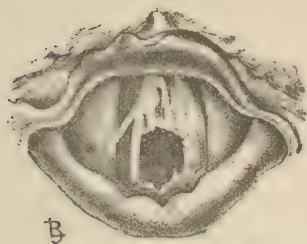
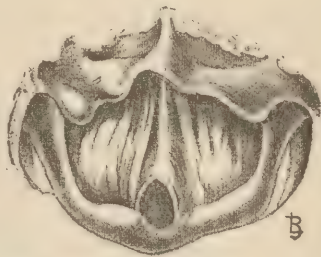


FIG. 18.



Illustrations of syphilitic stenosis.

of outgrowths or hyperplastic exuberance from the pharynx obstructing the glottic lumen, is shown in Fig. 2, on page 713.

It would be tedious to attempt a description of the various degrees and shapes of these webs, and a glance at the accompanying illustrations will afford as much information as a more exhaustive description. Of contemporary authors on this subject, Schrötter,³ Whistler,⁴ and Heryng⁵ may be especially consulted.

The symptoms are usually unmistakable; the voice is permanently hoarse or restricted in its register. The breathing is generally impeded, the dyspnoea varying in degree with the severity of the stenosis, the presence of oedema, and the amount of fixation of the arytenoids.

Intermittent attacks of dyspnoea continuing for many years are almost pathognomonic of a syphilitic laryngitis. The cough is usually spasmodic, with inspiratory stridor not unlike pertussis, and is variably aphonic. The expectoration is mostly scanty and mucous, whilst pain and odynphagia are rare.

The eccentricity of the deformity as shown by the laryngoscope, coupled with the patient's history, affords considerable help in the diagnosis, which is rarely difficult except when masked by a superadded tuberculosis, as occurred in a patient under the writer's care, who, after resisting the action of iodide of potassium and mercury, was treated by tuberculin, and responded to the remedy by a typical reaction, but died from disseminated tuberculosis.⁶

The elimination of tuberculosis from the diagnosis is not always easy, but the absence of odynphagia, of wasting, and of night-sweats, and the local features, will materially afford help to the removal of any doubt in this

¹ Syphilitic Membranoid Occlusion of the Rima Glottidis, New York, 1874.

² Vorlesungen über die Krankheiten des Kehlkopfes, IV. Lieferung, Wien, 1889.

³ Larynx-Stenosen, Wien, 1876, and Vorlesungen über die Krankheiten des Kehlkopfes, IV. Lieferung, Wien, 1889.

⁴ Syphilitic Strictures of the Larynx, London, 1881.

⁵ Transactions of the Seventh International Medical Congress, 1881, vol. iii. p. 242.

⁶ Journal of Laryngology, vol. v p. 180, London, 1891.

direction ; while the slowness of the progress, the general history, the absence of ulceration, of hemorrhage, and of pain in deglutition, together with the state of nutrition, will readily differentiate the disease from a malignant neoplasm.

Treatment must be based upon general principles, and should be determined by the degree of stenosis. When œdema supervenes, tracheotomy is generally required, which should always be performed as low down as possible, and removal of the tube should on no account be permitted, unless laryngoscopic examination indicates a disappearance of the physical destruction, for it not unfrequently happens that the tube may have to be worn for the rest of the patient's life. Such a warning may appear unnecessary, and would not be given had not the author been obliged to open the trachea a second time in the case of a man who had been previously tracheotomized without laryngoscopic investigation, with removal of the tube after insertion, for eleven weeks, during which time not a single application of the laryngeal mirror had been made, and all this in a large general hospital in London which boasts of a special throat department.

Intubation *per se* is rarely successful, for, although sometimes affording temporary relief, subsequent tracheotomy is, in the author's experience, almost always called for. The most satisfactory of all methods is undoubtedly that of a combination of cutting and dilatation. The latter alone (subsequently, of course, to tracheotomy) is extremely slow and uncertain in its results, and, although it has received much favorable notice from Schrötter and Heryng, of Warsaw, has not proved at all satisfactory in the author's own practice or in that of his colleagues. Figs. 19 and 20 illustrate a

case¹ treated by the writer's cutting dilator (Fig. 21), which has the advantage over all other similar instruments in that it at the same time acts as a respiratory canula, and may consequently be used in mild cases without a preliminary tracheotomy. Schrötter's tin and hard rubber dilators are largely used, and are in every respect useful.

Resection of a portion of the larynx as practised by Heine, Bruns, and

others, is, in the opinion of the writer, hardly justified either upon clinical grounds or by the results.

The combined operation of cutting and dilating, followed or not by the wearing of O'Dwyer's tubes or the passage of bougies, according to the requirements of the case, is, in the writer's judgment, the most rapid and satisfactory method: it has been warmly advocated by Lefferts,² who has

FIG. 19.



FIG. 20.



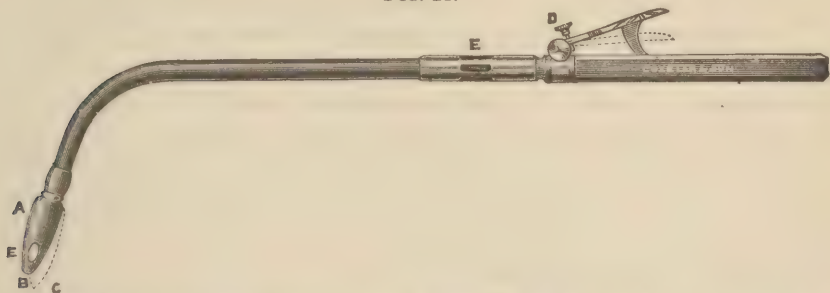
Cicatricial stenosis before and after treatment.

¹ Op. cit., p. 391.

² Transactions of the International Medical Congress, Berlin, 1890.

related several cases successfully treated thereby ; but when the patient is unwilling to permit adoption of these measures and time is no object, tracheotomy and the wearing of a pea-valve canula may occasionally prove successful. Such a procedure at least obviates all vital risk.

FIG. 21.



AUTHOR'S HOLLOW LARYNGEAL DILATOR, WITH CUTTING BLADE (one-third measurement).—A, terminal of the hollow dilator containing the cutting blade B, the extent of which is regulated by the screw at D ; E, E, openings for the passage of air.

Tuberculous Stenosis.—The ravages of tubercle in the larynx, whilst sometimes assuming a chronic form, are so invariably associated with ulceration, and are characterized by such feeble powers of repair, that whilst admitting the *possibility* of a cicatricial stenosis, its occurrence is so rare that detailed attention is hardly called for. When tubercular laryngitis heals up it generally does so at a somewhat early stage, before much deformity has been produced ; consequently the liability to stenosis is very slight.

Lupous Stenosis.—Stenosis of the larynx due to cicatrization of an old lupus is a deformity which has received very little attention, and in no systematic work except that of the writer has there been given any detailed account of the disease in its non-ulcerative or quiescent form, though excellent monographs had previously been published by Lefferts¹ and by Chiari and Riehl.²

The chief feature of this stenosis is either the formation of contracting bands or membranes, or a general matting together of the parts, rather than the development of hyperplastic elevations. Considering the extremely chronic nature of the disease, this feature is not surprising, and is in marked contrast with those of laryngeal phthisis. According to Virchow,³ however, the arytenoids may occasionally be surrounded by hard papillary outgrowths, though such a condition is, probably, more often associated with the *active* stages of the disease.

The scar-tissue is extremely dense, unyielding, persistent, and often abundant ; qualities which do not enable the writer to agree with Gottstein's

¹ American Journal of the Medical Sciences, vol. lxxv. p. 370 *et seq.*

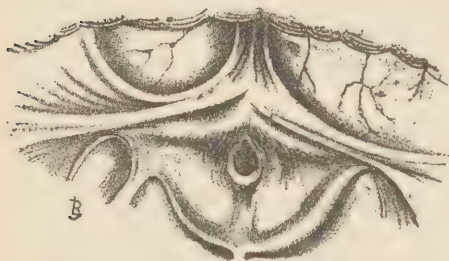
² Vierteljahresschrift für Dermatologie und Syphilis, IX. Jahrg., Heft 4, 1882.

³ Die krankhaften Geschwülste, Bd. ii. p. 490.

statement that the infiltration is often absorbed. When the nodular appearance is well marked it is not infrequently followed by a remarkable flattening, after an attack of erysipelas or as a result of tuberculin injections (both of which agents are strikingly similar in their effects), generally, however, at the expense of the breathing-space. This was well shown in a case recently under the writer's care at the Central London Throat, Nose, and Ear Hospital, of a girl, aged eighteen, who came under treatment in January of the present year for lupus of the nose, pharynx, and larynx of ten years' duration. The larynx presented some well-marked lupus scars and a few pale nodules, but was practically quiescent; whilst under lactic acid treatment applied to the nose she developed a violent attack of erysipelas, which soon subsided; an almost clear nasal space and a well-marked flattening of the laryngeal mucous membrane resulted, the nodules being replaced by pale healthy scar-tissue.¹

With regard to the etiology of lupus, an exhaustive discussion would be out of place in this article: let the statement be sufficient that it may be considered as an attenuated form of tuberculosis; for although lupus and true tuberculosis may be distinct, in their clinical behavior they both possess strong morphological resemblances. The laryngoscopic appearance of the disease in its later stage of cicatricial narrowing is well shown in Fig. 22,

FIG. 22.



Supra-glottic stenosis of larynx due to lupus.

which exemplifies the "general matting together" of the parts, leaving but a small orifice for breathing purposes. The case illustrated by this figure has been fully reported:² there were marked pallor and loss of sensibility of the whole of the mucous membrane. There was no indication of any active inflammation. The epiglottis, which had nearly disappeared, was represented by

several tight cicatricial cords, and its cushion was continuous in plane with the ventricular bands, which were themselves merged with the ary-epiglottic folds. In the centre was a small opening about the size of a goose-quill and on a higher level than the vocal cords, which, from the good quality of the voice, were apparently unaffected.

The tissues, as in this case, are generally anæmic, except when a small rosy nodule gives warning of active cell changes in the shape of a re-awakening of inflammation.

The functional symptoms are slight and out of all proportion to the physical signs revealed by the laryngoscope: dysphagia, odynphagia, and

¹ Journal of Laryngology, vol. vi., No. 5, p. 204, London, 1892.

² Op. cit., pp. 427-28.

dyspnœa are rarely present, the "conspicuous absence" of these features contrasting strongly with the manifestations of a truly tuberculous process; and it is only when the stenosis is at all severe, or when the sleeping dog chronicity is aroused by active measures, that disturbances of the voice and respiration arise.

In the observation already quoted, notwithstanding the advanced atresia, the voice was only slightly modified, and the only indication of the disease was a slight degree of stridor. As a rule, in fact, patients are unaware of their condition, but the inevitable exceptions are supplied by Asch¹ and Lefferts,² who have each related cases which were marked by considerable dysphagia, cough, hoarseness, and a sense of obstruction in the throat.

The *diagnosis* rarely presents any serious difficulties. The situation of the web is a not unimportant guide, for whilst in lupus the changes are mostly *supra-glottic*, in syphilis and tubercle the *rimal* and *infra-rimal* structures are preferably attacked. Apart from this, the general clinical features, the patient's history, and the reaction to drugs are points of distinction which facilitate its recognition.

It may be here remarked that a laryngoscopic examination is often of service in the differential diagnosis of a questionable skin-eruption, a fact which has been strikingly illustrated in the writer's clinic; for in by far the greater number of cases presenting lupus of the nose, pharynx, and face, he found unmistakable signs of laryngeal lupus especially involving the epiglottis. In not one of these, however, had the patient complained of laryngeal symptoms. Notwithstanding this experience, the author hazards the suggestion that Lefferts goes too far when he doubts the accuracy of the diagnosis of any case as lupus of the larynx in which there is no history of previous or concurrent skin-disease.

From leprosy, apart from the extreme rarity of that disease, indications of its manifestation in other parts of the body will suffice. From innocent and malignant growths no laryngologist of any experience could possibly fail to differentiate a lupus.

The *prognosis* is, on the whole, not unfavorable, provided that the patient be carefully watched for a time and the stenosis be properly treated, should symptoms arise.

That lupous deposits may undergo a spontaneous though gradual atrophy the author fully believes, but not without leaving behind some well-marked traces of its ravages. The possibility of a subsequent true tuberculosis must also be kept in mind.

The *treatment* should be determined by the severity of the stenosis, and should be based upon the same general principles that ought to guide the treatment of congenital and syphilitic bands.

Tracheotomy, except as a preliminary to endo-laryngeal measures, is

¹ Archives of Laryngology, vol. ii. p. 273, New York, 1881.

² Op. cit.

rarely called for. Intubation is of little permanent value, since the scar-tissue is so extremely dense and resilient as to resist all attempts at simple stretching, and it is useful only when made supplemental to the cutting or slitting of the web.

It need hardly be remarked that surgical interference with the intrinsic tissues should not be undertaken till all signs of active inflammation have ceased, nor in any case unless there are urgent respiratory symptoms calling for aid. It is important, however, that once the condition is recognized the patient should be warned to take prompt notice of any signs of renewed activity.

Leprous Stenosis.—Stenosis of the larynx due to leprosy occurs at so late a period of the disease that it need only be considered with regard to the question of relieving the patient from impending asphyxia by tracheotomy.

II. EVERSION OF THE VENTRICLE, OR DISLOCATION OF THE SACCULUS LARYNGIS.

This is a form of laryngeal deformity which in itself hardly amounts to stenosis, yet this article would be incomplete were it not described. Probably it is not so rare a lesion as has been believed, and in addition to the cases of true eversion, there are, as Major¹ has observed, many of prolapse, which, although a preliminary of eversion, may sometimes occur without this further development.

Three prominent examples of true eversion which have been recorded may be quoted. The first, by Moxon,² was only discovered post mortem. It appeared as a small semi-elliptical mass hanging down over one vocal cord, was continuous with the anterior half of the ventricle, and corresponded with the sacculus, which was wanting in its normal position. A second, related by Morell Mackenzie³ and illustrated by the writer, was that of a patient (age unrecorded) who was admitted into hospital in such a debilitated state that he died on the following day. The post-mortem examination revealed a condition similar to the foregoing, but with the addition of ulceration on the opposite side of the larynx and well-marked destruction of gland-tissue.

A third example, recorded by Lefferts,⁴ is the most interesting, for, unlike the preceding cases, that of this author was recognized during life. Both ventricles were everted, the left being also greatly hypertrophied. The history pointed to the hernia having occurred twenty years previously during sleep; since this event the patient had suffered with hoarseness and subsequently with dyspnoea. It was treated by thyrotomy and excision of the prolapsed saccules.

It has been suggested that eversion in the cases of Moxon and Mackenzie

¹ New York Medical Journal, January, 1887.

² Transactions of the Pathological Society of London, vol. xix. p. 65.

³ Essay on Growths in the Larynx, 1871, p. 34, and Plate V. Fig. 2.

⁴ New York Medical Record, June 3, 1876.

occurred *in articulo mortis*, but for this view no reasons are given, and it is an interpretation which, in the absence of any disease, is difficult of acceptance, for the sacculus is so closely adherent to the surrounding structures that spontaneous eversion is a practical impossibility. That disease of the perichondrium, of the cellular tissue, or of the gland substance may have been the predisposing if not the exciting cause, is shown by the existence of an ulcerative process in both Mackenzie's and Lefferts's cases. Moreover, Gouguenheim¹ has found that tubercular disease was responsible for four out of five cases which he reported to the French Congress of Laryngology in 1889, while three out of five of Major's cases occurred in individuals with a syphilitic history. Predborski² found a case in a strong man who had abused alcohol.

Diagnosis by means of the laryngoscope of this condition from neoplasms may present some difficulties, and the existence of such a deformity should always be borne in mind.

Removal by means of the snare or cutting forceps is perhaps the simplest form of treatment, after having attempted replacement by an appropriate repositor, though even if this be effected relapse of the deformity would be highly probable; others have been treated by applications of chromic acid. The heroic measures of Lefferts are hardly likely to be generally adopted.

III. NEOPLASMS OF THE LARYNX.

A. INNOCENT NEOPLASMS.

Definition.—Purely local tumors, homologous in structure.

General Etiology.—The origin of laryngeal neoplasms as well as of new growths in other situations must be considered under two heads,—first, the purely local, and secondly, the constitutional. Of local causes, irritation plays the most important rôle, leading as it does to hyperæmia and increased cell-activity, persistence and exaggeration of which may endanger life, either by producing a tumor sufficiently large to interfere seriously with respiration, or by the assumption of other properties which constitute malignancy.

Irritation in the larynx for the most part arises from the breathing of imperfectly filtered air, due either to a surcharge of the atmosphere with material or gaseous impurities, or to imperfections in the upper respiratory tract, such as hypertrophic and atrophic rhinitis, deviations of the nasal septum, nasal polypi, naso-pharyngeal adenoids, enlarged tonsils, etc., most of which give rise to mouth-breathing, which in turn, causing frequent laryngeal explosions, keeps the structures in a state of continuous congestion, and so favors local hypertrophy. This subject has already received attention under the heading of congenital papillomata.

Considering the important part which mechanical irritation plays in the production of cutaneous warts, it is only fair to assume that it may be

¹ Journal of Laryngology, vol. iv., 1860 p. 32.

² Gazeta Lekarska, Nos 51 and 52, 1888.

equally responsible for the origin of laryngeal excrescences. Whether there may be an increased "local vulnerability" of the tissues without an exciting cause is still an open question. Still it must be admitted that a catarrhal state, especially when combined with excessive functional activity, —professional use of the voice,—is a powerful predisposing factor. These conditions were well illustrated in the case of a drill-sergeant, aged sixty, who consulted the writer in 1879 for hoarseness of eighteen months' duration and complete aphonia for six weeks. He was not a temperate man, and had a strong catarrhal tendency, with a history of early syphilis.

FIG. 23.



Three large masses of papillomata were seen (Fig. 23), and removed by the snare. The voice being restored, the patient subsequently resumed his drill duties.

That functional abuse plays an important part directly or indirectly in the production of laryngeal growths cannot be denied, considering the frequency with which they are found in costermong-

gers, singers, etc. Morell Mackenzie reports twenty-one cases as occurring to professional voice-users, out of one hundred of laryngeal growth. The writer's own experience amply illustrates the etiological importance of vocal abuse, and especially that of professional use of the voice when carried on under unfavorable hygienic circumstances. For instance, he has reported the case of a school-master who carried on his work in close school-rooms with much surrounding noise; of hawkers, costermongers, and military officers who use their voice in the open air and under all conditions of weather; of a choir-boy who in laudable endeavors "to sing out" shouted so as to be heard above his fellows; of another who unduly forced his register; of an actor working under adverse conditions of night hours, gas- and dust-laden—and probably insanitary—atmospheres; and lastly of growths occurring in boys who have been allowed to sing during the laryngeal changes associated with puberty.

Apart from the local redundances recognized in subjects suffering with syphilis, tuberculosis, etc., the evidence of a well-defined constitutional influence is somewhat scanty. Occurring, as these growths do, in patients whose history fails to reveal any particular dyscrasia, it must be admitted that patients (especially adolescents) are often seen who in addition to a laryngeal papilloma may present an extraordinary predisposition to the formation of warts on other parts of the body-surface,¹ so constituting what may be termed a "warty diathesis."² Against this suggestion it may be

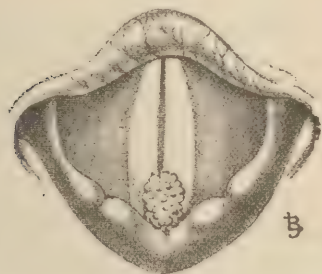
¹ Fauvel, *Traité pratique des Maladies du Larynx*, Paris, 1876, p. 200.

² The author has also recorded an analogous case of the association of mucous polypi of the nose with polypi in other mucous tracts, as well as of warts on the body surface. *Op. cit.*, p. 542.

argued that the larynx and the skin are totally different in their developmental origin; and, admitting the importance of this objection, it must not be overlooked that warts nearly always occur in regions covered by stratified epithelium, for it is a point of great significance that those regions of the larynx covered with ciliated cells are rarely primarily affected by papillomata, and that a tumor in those situations must be always looked upon with great suspicion of malignancy.

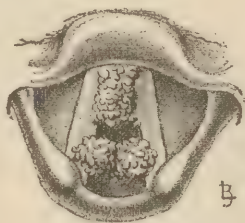
The writer does not agree with the view held by Morell Mackenzie that the diathetic conditions of syphilis, tubercle, etc., "exercise a decidedly antagonistic influence to the development of new formations,"¹ his (the writer's) experience being quite the reverse; the patient with multiple papilloma already referred to, as well as that with a single one (Fig. 24),

FIG. 24.



Single papilloma with syphilitic history.

FIG. 25.



Symmetrical papillomata with syphilitic history.

and another of symmetrical growths (Fig. 25), having all been the victims of syphilis. Other classes of growth, such as the myxomata and adenomata, both to be presently discussed, may likewise be dependent on, or at least associated with, the same dyscrasia.

Another well-marked illustration is at present under the care of the writer's colleague, Dundas Grant; that of a man, aged fifty-nine, who contracted syphilis twenty years ago, and during the last twelve months has had as many as ten portions of true papillomatous growth removed from his vocal cords. He has none of the usual signs of tertiary syphilis of the larynx, but there are numerous indications in other parts of the body.

A still further corroboration of the writer's view is afforded by Mackenzie himself,² in the person of a woman who suffered with tertiary ulceration of the tongue, and a well-defined papilloma growing from the inter-arytenoid fold, which was removed with temporary good results, but who died some two years later from syphilitic cachexia.

So that these and other dyscrasiæ, instead of antagonizing the formation of neoplasms, are undoubtedly predisposing if not exciting causes, and probably act by inducing a low state of resistance, or, in other words, a high vulnerability of the parts concerned.

¹ Mackenzie, *Essay on Growths in the Larynx*, Churchill, 1871, p. 9.

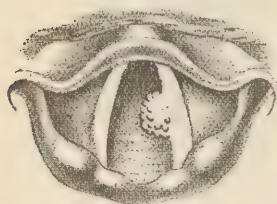
² *Op. cit.*, Case 96, p. 194.

1. *Papillomata*.—*Definition*.—Elevations of the mucous membrane of the larynx occurring singly or in groups, homologous in structure and innocent in nature.

This type of neoplasm heads the list of benign growths which occur in the larynx from the points of view of both interest and of number; and the experience of every laryngoscopist precludes the necessity for any laborious or exhaustive statistical evidence upon these points.

Any attempt to classify papillomata according to their color, shape, size, density, or multiplicity would be an unnecessary and confusing refinement; suffice it to say that they may occur as simple, conical, or rounded elevations, with broad bases, smooth velvet-like or filiform surfaces; as fungiform processes with restricted bases, or as cauliflower-like masses, either of which may be white, red, or even blue in color. In size they may vary from that of a mustard-seed to that of a filbert.

FIG. 26.



Papilloma of vocal cord in the common situation.

Although papillomata are found in all parts of the vocal aperture, their situation is for the most part about the central third of a vocal cord (Fig. 26): as a rule, congenital growths arise in the anterior third, whilst those in the middle or posterior third are more probably inflammatory and dyscrasic in origin. Papillomata are generally single; when multiple they may be sometimes symmetrical, especially when recurring. Moreover, when growths recur they

frequently appear in fresh sites. The right cord is more frequently involved than the left, and the growths rarely occur—at least in the first instance—on any part other than the vocal cords. Warts may, however, be found simultaneously on the uvula and other parts of the mouth. Microscopically the papillomata consist of stratified epithelium covering a “core” of more or less vascular connective tissue. The most significant feature is that the epithelium grows in an *outward* direction and never invades the subjacent tissue, a point which histologically differentiates them from epitheliomata, in which the cells grow *inward*.

Notwithstanding that Morell Mackenzie states that “laminated capsules are never found,”¹ “nests” or “pearls” are occasionally to be demonstrated, but they are small and correspond with transverse sections of the clefts between each papilla, and must not be confused with transverse sections of the “cores” of the fimbriæ, which, of course, contain connective tissue and blood-vessels and sometimes gland-substance at the base. Fig. 27 is a striking illustration of this fact. The structure which is typically papillomatous is apparently infected with “nests,” but these are simply transverse sections of fimbriæ, composed of connective tissue, surrounded by epithelial laminae, and are entirely distinct from the “pearls” of epithe-

¹ Op. cit., p. 46.

lioma, as demonstrated in the illustration of papilloma of the pharynx on a previous page. After repeated attempts at removal, small-cell inflammatory tissue may also be discovered. As a rule, papillomata grow slowly, but when irritated may sprout very rapidly and persistently recur for even lengthy periods.

The *diagnosis* rarely presents much difficulty, the foregoing physical features, followed by a microscopic examination after removal, being generally sufficient.

Should the laryngeal sound be employed, a proceeding which the writer considers to be not often necessary, the growth will be but rarely seen to bleed, a feature which differentiates it from cancer as well as from a papilloma due to an inflammatory dyscrasia. Sometimes, however, a growth is accompanied by so much redness and swelling that a diagnosis from early malignancy, syphilis, and tuberculosis may be difficult, and the observer may justly hesitate to give an opinion until prolonged watching and exhaustion of every method of observation shall have eliminated doubt. The movements of the vocal cords are but rarely impaired even when the growth is of considerable size, a feature which to a great extent excludes malignancy and inflammatory deposit about the articulation.

The *symptoms* will vary within very wide limits, according to the size, number, and situation of the growths. In nearly every instance the voice will be more or less impaired, both for speaking and for singing, the alteration varying from a slight hoarseness to a complete aphonia; the voice will often be observed to change during the utterance of very short sentences and become diphthonic, whilst the succeeding sentence may be spoken in an almost natural tone. Want of proper control over the voice constitutes in fact one of the earliest functional symptoms of a growth involving the vocal cords, though occasionally, when the growth is small and springs from the under surface of the cords or from the interarytenoid fold, no change will have been noted.

Cough may or may not be present. In the young it may assume the "croupy" type (so generally associated with adenoids), and may occur in sudden and severe paroxysms. Slight hæmoptysis may follow a sudden fit of coughing, but this is decidedly rare in the purely local variety of papilloma; and is, moreover, a symptom which might indicate malignancy.

FIG. 27.



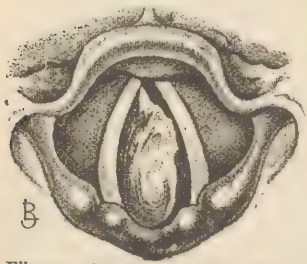
Histological features of a papilloma.

Respiration is interfered with only when the growths are multiple and large, in which cases the dyspnœa may cause serious alarm and require prompt measures. Unlike what is observed in malignancy or inflammatory infiltration, the cords are rarely fixed, and the dyspnœa is due to the mere presence of mechanical obstruction to the breath-way. It occasionally happens that the patient can lie upon one side only, namely, that corresponding with the vocal cord to which the growth is attached, the adoption of the other side being attended with much dyspnœa, due to the valve-like obliteration of the vocal space. These attacks for the most part happen during the night, or, it may be, whilst taking food, the constrictors of the vestibule being mechanically impeded. When *stridor* occurs it is generally inspiratory. *Pain, dysphagia, and odynphagia* are rare.

2. *Fibromata*.—These growths, although placed next to the papillomata in the order of frequency, are far less common, are rarely found before the age of twenty-five, and grow very slowly.

They are nearly always single, and, while they mostly spring from the vocal cords, may occur in any part of the larynx, generally taking for their

Fig. 28.



Fibroma situated on under surface of right vocal cord.

starting-point the sub-epithelial connective tissue, or even the perichondrium. In size, fibromata may vary from that of a millet-seed to that of a filbert, and may completely fill the glottic space (*vide* Fig. 28). For the most part smooth, they may be indented or rough, dense in consistence, and may vary in color from a pale cream to a deep cherry-red. When small they are sessile, but they occasionally become pedunculated with increase of size. Although encapsuled, the sac can rarely be stripped from its contents, which

consist of dense fibrous tissue with a scanty development of blood-vessels. The cells are so closely packed that their outlines are almost invisible, whilst the nuclei are elongated and narrow.

The symptoms will partake of the same nature as those which characterize papillomata, and may be well illustrated in the following case, which is at present under the author's care at the Central London Throat, Nose, and Ear Hospital, and from which the foregoing illustration was taken. A woman, aged forty-five, was admitted to the out-patients' department in April, 1890, for loss of voice, dyspnœa, and dysphagia. She had been subject to colds and bronchitis for several years, and eighteen months previously lost her voice suddenly, which circumstance was attributed to a cold; it partially returned, but never recovered its normal character, and for two months prior to admission she rarely spoke beyond a whisper. Her cough, which was then very troublesome, had been once or twice associated with slight attacks of hæmoptysis. The voice occasionally changed from a whisper to a squeak. Her breathing was greatly embarrassed, and she

could lie only upon the right side when sleeping. There was much expiratory stridor and occasional odynophagia. The lungs gave evidence of imperfect expansion, and she was greatly emaciated.

Laryngoscopic examination revealed a large, pale, smooth mass springing from the under surface of the right vocal cord, and extending well beyond the middle line, even on inspiration. The left vocal cord moved freely, but the right only in part. On phonation there was no sign of the growth. On October 18 she was admitted as an in-patient, with markedly increased symptoms, but the growth was apparently unchanged. On November 7 tracheotomy was performed, and, the symptoms being so much relieved, she left the hospital at her own request, wearing a pea-valve tube, on December 15. The following May, 1891, she was again admitted, and an attempt to remove the growth by means of a snare was made, both from below and from above, but only a small piece was detached, and, objecting to any further operative measures, she was discharged, still wearing the tube. At the time of writing she enjoys good health, the lungs are well expanded, and she can phonate remarkably well considering the condition of the larynx.

Microscopically the portion removed was composed of densely-packed, elongated fibrous-tissue cells.

Figure 29 illustrates the smaller variety, which occurred in the person of a female hawk, aged thirty-eight, under the writer's care.

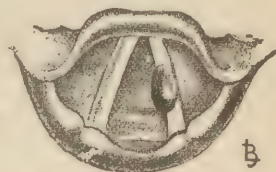
In this case the growth was removed at the first attempt.

The diagnosis of a laryngeal fibroma from a myxoma, adenoma, or angioma may at first be somewhat difficult until a knowledge of its consistence is obtained. The history, together with an absence of ulceration and a comparative freedom of the vocal cords from any infiltration, will suffice for the exclusion of malignancy.

3. *Fibro-cellular Growths, Mucous Polypi, and Myxomata* possess such strongly marked points of histological resemblance that they readily admit of being grouped together; for whatever difference there may be is one only of degree. They are usually enclosed in a fibrous or hyaline capsule covered by squamous or ciliated epithelium, and containing branched, fibrillated, and fusiform cells embedded in a homogeneous matrix of mucin in which round nucleated bodies with thin prolongations are often seen. In some cases the matrix may be in excess, in others the cells, yet the same general features persist. Blood-vessels with thin walls are sparsely distributed.

These growths vary in size and situation, but, unlike papillomata, are not so closely confined to the vocal cords, since they may start in the sacculus, the epiglottis, the ventricular bands, or in any other part of the larynx.

FIG. 29.



Fibroma of left vocal cord.

They have a somewhat translucent appearance, are smooth of surface, and are either red or gray in color. Figure 30 is a good illustration of a small myxoma.

FIG. 30.



Myxoma of right vocal cord.

It was taken from a male patient aged thirty, a bass singer. The growth consisted of a small myxomatous polyp growing by a fine pedicle from the right vocal cord, and, curious to relate, caused no interference with the singing voice, it flapping up on to the surface of the cord with the expiratory blast of phonation.

Another case also under the writer's care was that of a woman aged twenty-two, who had a history of syphilis. She had suffered with aphonia for six months, and on examination a small red polypoid growth (Fig. 31) was seen in the anterior commissure below the vocal cords, which was removed by a Gibbs snare with complete recovery of the voice. It is not uncommon to find one or more mucous growths

FIG. 31.



Fibro-myxoma of larynx.

FIG. 32.



Mucous growths of larynx accompanying papillomata.

of small size occurring in a larynx which is the seat of other varieties of neoplasm, especially of a papilloma (Fig. 32).

These growths occur for the most part about middle age, rarely assume large proportions, and give no trouble after removal. The recognition of their true nature may be attended by some slight difficulty, but the exclusion of malignancy is quite easy if the microscope be employed to establish the diagnosis.

4. *Adenomata* are still more rare than either of the preceding kinds. They appear as sessile cauliflower or tuberculated elevations in those parts of the larynx in which glands mostly occur, such as the epiglottis and sacculus. They are purely homologous, and consist merely of an hypertrophy of the normal acino-tubular gland-substance. Such a growth must in all cases be regarded with grave suspicion, for, after all, the term "adenoma" may be a mere euphemism for a "quiet cancer." A case¹ related by Morell Mackenzie (Fig. 33) proves the importance of this warning. It

¹ Essay on Growths in the Larynx, p. 28.

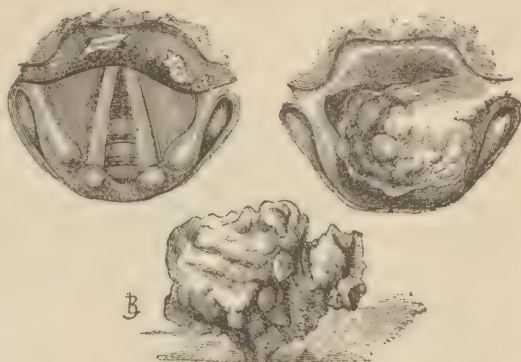
figures in his monograph as an adenoma due to syphilis, but upon examination by the Morbid Growths Committee of the Pathological Society¹ it was reported as being an "adenoid carcinoma," which view was fully verified by the patient subsequently dying of malignant disease of the larynx, and in his later and larger manual Mackenzie reported it as malignant.

The *diagnosis* of this species of growth can be at the most provisional, and the *prognosis* must be carefully guarded.

5. *Cystomata* or *Mucocoeles* are somewhat rare, but of more frequent occurrence than are adenomata, though Moure,² who has reported ninety-two observed and collated cases, is of opinion that next to papillomata they are, of all benign laryngeal growths, the most frequent; they originate in the gland-substance, and are consequently found most frequently on the epiglottis and in the ventricle of the larynx. They may result from occlusion of a duct or from cystic degeneration of an acinus or lobule, the contents being purely mucoid. Generally red in color, with surrounding hyperæmia, they sometimes attain considerable size. They occur for the most part in middle life, but a case is recorded by Edis³ in which a cyst the size of a hazel-nut caused the death of an infant thirty-seven hours after birth; this was of course congenital. Cysts do not recur after removal, and, unless they assume a large size, do not cause any serious symptoms. In a case recorded by Morgan⁴ there was violent paroxysmal cough and nausea accompanying a small cyst on the epiglottis, which was removed by forceps, with a speedy abatement of the symptoms.

6. *Angiomata* are said to be extremely rare tumors in the larynx; at any rate the record is but scanty; but while Glasgow⁵ could collect but six in 1888, Wolfenden⁶ was enabled in the same year to report double that number. Morell Mackenzie relates only one example as having occurred in his own practice, and that, as do doubtless some of the others, lacked the true characteristics of a vascular neoplasm.

FIG. 33.



ADENOMA OF THE LARYNX (Morell Mackenzie).—The first drawing illustrates the laryngeal appearance of slight ulceration, three months before the second, when the growth was developed, and the third drawing shows the removed mass.

¹ Transactions of the Pathological Society of London, vol. xxi.

² Revue Mensuelle de Laryngologie, 1881, vol. i. p. 75, *et seq.*

³ Transactions of the Obstetric Society, vol. xviii. p. 2.

⁴ Archives of Laryngology, vol. iii., No. 2, April, 1882.

⁵ Transactions of the American Laryngological Association, 1888, p. 146.

⁶ Journal of Laryngology, 1888, vol. ii. p. 291.

Vascular tumors of the larynx doubtless originate from continued local congestion in patients possessing a predisposition to varix. Loomis¹ reports such a case, in which an angioma involved one side of the neck, face, tongue, pharynx, and larynx. In this last situation there were two growths, one the size of a large pea projecting from the left ventricle, and the other the size of a cherry from the lowest part of the ary-epiglottic fold. On the whole, angiomata appear to give rise to less functional disturbance than papillomata, —a considerable proportion of those recorded not having involved the vocal cord. They may, however, be the cause of recurrent hemorrhages, which without laryngoscopic evidence might tend to a mistaken diagnosis of pulmonary disease. The following example under the writer's care² is suggestive of the probability that angiomata are not quite so uncommon as is believed, for without histological evidence the growth would certainly, on naked-eye investigation, have been taken for a papilloma. The case was that of a gentleman, aged forty, who came under treatment in May, 1891, for hoarseness and vocal fatigue of two and a half years' duration, attributed to exposure to the influence of a dense London fog. He had previously consulted a specialist, who had recognized the presence of a growth and unsuccessfully attempted its removal, for on examination considerable inflammatory swelling and superficial ulceration were observable in the larynx, this subsiding a week later; at the anterior insertion of the vocal cords was found a small, round, smooth growth of a pink color, which was removed by a Gibbs snare, the operation being quickly followed by complete restoration of the voice.

Microscopic examination of the growth proved it to be a thrombosed angioma. It consisted of loosely-arranged connective tissue showing mucoid changes, embedded in which were vascular channels with thin walls and a few visceral muscle-fibres. One of the cavernous spaces was distended with a large mass of laminated fibrin, with some granular pigment here and there. Some of the smaller vascular channels were also obliterated by fibrin (Figs. 34 and 35). Most histological records of angiomata record myxomatous changes with a tendency also to fibrous transitions.

In the case of Morell Mackenzie already referred to,³ the diagnosis of an angioma was but faintly corroborated by the microscopic report, for it contained neither blood-vessels nor blood, and consisted of closely-matted fibrous tissue and elongated nuclei, structures which scarcely justify the use of the term angioma. This growth, in size and appearance resembling a ripe blackberry, was removed with tube-forceps from the right hyoid fossa of a man aged thirty-five, in whom the only symptom was an uneasy tickling sensation in the throat.

A somewhat similar case is reported by Semon and Shattock,⁴ in which

¹ Medical Record, New York, April 6, 1890.

² Journal of Laryngology, vol. v. No. 7, p. 295.

³ Essay on Growths in the Larynx, London, 1871, p. 188.

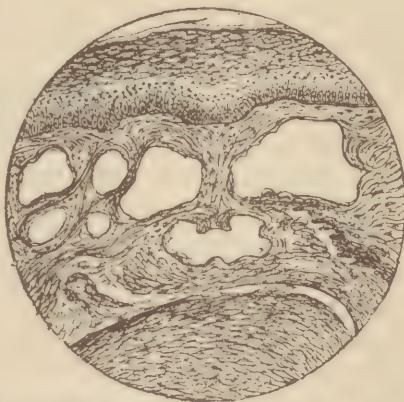
⁴ British Medical Journal, May 23, 1891, p. 1127, and Transactions of the Pathological Society, vol. xlii. p. 37.

microscopic investigation entirely upset the diagnosis formed by laryngoscopic observation. The patient, aged forty-four, was the subject of a tumor of the size of a small mulberry, which sprang apparently from the left pyriform sinus and overhung the entire left posterior part of the larynx.

FIG. 34.



FIG. 35.



Thrombosed angioma of the larynx, showing (34) complete section and (35) detail of structure.

It was mostly bluish, in part bluish red, somewhat lobulated, and of a smooth surface, so that its appearance entirely seemed to justify the diagnosis of an angioma, and even after removal the same impression was conveyed, since it was completely encased in a shell of partly organized blood-clot; but on microscopic examination it turned out to be a genuine papilloma. Glasgow, in the case reported by him, has called attention to a peculiar translucent appearance of the growth, through which the cord could be clearly seen. It is probable that this was the result of mucoid change.

7. *Lipomata*.—Lipomata are extremely rare in the larynx. One case is recorded by Bruns¹ in which a fatty growth containing a nodule of cartilage was removed from a patient aged twenty-five. It was a large mass and entirely occluded the laryngeal orifice, having apparently started from the left ary-epiglottic fold. Removal piecemeal by galvano-caustic treatment was partially successful.

8. *Enchondromata* are the least frequent of all benign neoplasms. Morell Mackenzie² reports but one, and the present writer has no personal experience of this variety of the few recorded. Only two or three have been discovered during life.³ They always originate from a laryngeal cartilage, and may be found springing from either the thyroid, arytenoid, or cricoid. They are, for the most part, rather outgrowths or enchondroses than actual new formations.

¹ Polypen des Kehlkopfes, Tübingen, 1868, p. 17.

² Essay on Growths in the Larynx, London, 1871, p. 54.

³ Asch, Transactions of the American Laryngological Association, 1884, p. 66, and Ingals, *ibid.*, 1888, p. 126, and 1890, p. 52.

It will be seen from the foregoing that, with the exception of papillomata and fibroid growths, the remaining benign neoplasms found in the larynx may reasonably be considered as pathological curiosities.

Collectively the prognosis is good, but must at all times be guarded, especially in relation to the papillomata, for, apart from the persistent homologous recurrence of these growths, there must always be borne in mind the possibility of malignant properties developing subsequently, since the transition from an upward-growing papilloma to a downward-spreading epithelioma is a very short step.

Treatment.—The considerations which should guide surgical interference with presumably benign growths of the larynx were exhaustively treated by the writer many years ago,¹ and reprinted more or less fully in the several editions of his systematic treatise. They may be briefly summarized under the following headings: 1. That, simple and for the most part safe and innocuous as the removal of innocent growths generally is in the hands of an expert, small neoplasms causing but slight symptoms are not to be removed without consideration, since attempts at eradication are capable of leading to fatal results from direct injury to the healthy parts, particularly when unguarded instruments are employed. 2. That in many instances a “masterly inactivity” will be justified by spontaneous disappearance of the growths. 3. That a local recurrence is always probable, especially when the removal has been incomplete, or when the tissues possess a high degree of vulnerability. 4. That a simple growth may be irritated and aggravated by treatment—remedial or operative—until it assumes a malignant aggressiveness. This subject will be further discussed when considering the etiology of malignant neoplasms. 5. That the choice of instruments and the methods of operation are details of more than slight importance. 6. That an *extra-laryngeal* method is justifiable only in the event of a failure of all other methods and when life is endangered from suffocation.

The moral of all these considerations is clear, and, unpopular as it may be to the young enthusiast fresh from a European clinic where growths are as plentiful as fruit on a tree and their removal apparently as simple, the writer has in a long course of practice had frequent opportunities of testing their truth.

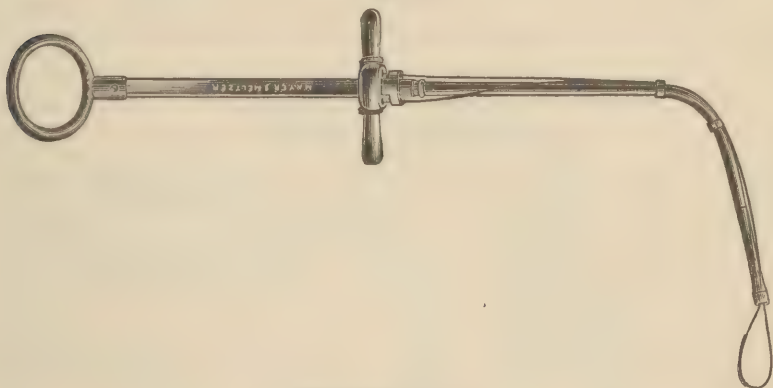
Granted that a growth requires to be removed, the following is the course of operative measures to be recommended.

Education of the larynx, combined with the administration of bromides and the sucking of ice, so often adopted in earlier days in order to overcome reflex sensibility, and in other circumstances local anæsthesia, by painting of chloroform and morphia, a tedious and by no means always an innocuous procedure, all these are now obsolete. Having decided to remove a growth, cocaine is first applied by means of a cotton-wool brush to the fauces and to the larynx, directed by the mirror. Experience seems to show

¹ British Medical Journal, May 8, 1875.

that it is better to make two or three repeated applications, at intervals of six or eight minutes, of a five- or, at most, ten-per-cent. solution, than to employ those of greater strength, since these last are sometimes attended with toxic symptoms. Once or twice, in the writer's practice, when applications of this nature have not been successful in allaying reflex irritation,

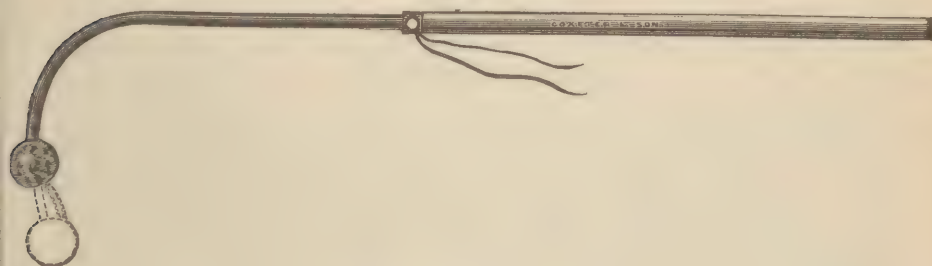
FIG. 36.



Gibbs's laryngeal snare.

a small quantity of cocaine has with advantage been injected subcutaneously. Local anaesthesia being thus obtained, the patient holds out his tongue with his right hand, and the surgeon, handling the mirror with his left hand, introduces with his right the snare (Fig. 36), or the laryngeal sponge-probang (Fig. 37), until he sees that it has passed the epiglottis; he then, remembering the antero-posterior inversion of the laryngeal image, passes the instrument well forward; that is, in the contrary direction to what would appear to the unpractised eye to be indicated by the mirror, and it requires some experience to overcome the tendency to pass it backward.

FIG. 37.



Voltolini's laryngeal sponge-probang.

If anaesthesia is not complete, the larynx closes round the instrument the moment it enters the vestibule, and the surgeon will have to trust to his previously ascertained knowledge of the position of the growth as to whether he passes his snare to right or left, to back or front, of the larynx.

In many cases there is considerable spasm, which makes it difficult for

the instrument to penetrate beneath the glottis, and some amount of force—or, better still, a little patience—is required. The latter is naturally to be preferred, since force in the case of a snare of fine wire, especially if the loop is large, may bend the loop on itself, and there is really no occasion for hurry; the glottis is sure to open in a second or two, and then this difficulty is overcome. If a growth is situated anteriorly or on either side, a finger of the surgeon's left hand (the mirror being withdrawn so soon as the operator is sure that the instrument is in the larynx) may be placed externally in the corresponding situation, so as to give a *point d'appui*. If the growth be situated posteriorly, the patient may be asked to assist by making the act of swallowing. When a loop is used, it is gradually tightened by traction and withdrawn after the surgeon feels he has placed it in a favorable position for catching the growth; but if the sponge be employed, it may be rubbed up and down several times with considerable firmness, the sponge being charged with a solution of chloride of zinc or sulphate of copper, or the cocaine solution may be employed to moisten it, with a view of allaying after-pain. On the withdrawal of any endo-laryngeal instrument—no matter what the character—spasm often occurs, though this symptom is less marked in the case of instruments incapable of “nipping” a cord, a cartilage, or a piece of healthy mucous membrane, and its severity is also modified when cocaine has been previously well applied. A few whiffs of chloroform, which should always be at hand, or a sip or two of cold water, will usually allay discomfort of this character. It is not well to repeat attempts at removal many times at a single sitting, for the threefold reason that (1) the larynx becomes more sensitive with repeated attempts; (2) spasm is more likely to occur; and (3) there is risk of setting up inflammation, and possibly œdema. Moreover, the moral effect of repeatedly unsuccessful attempts is not calculated to improve the chances of a further trial. Should a practitioner attempt to remove a growth according to the foregoing instructions—and every one must have a beginning—he will not be less successful in knowledge of the circumstance that if he does not catch the growth there will be but little risk with these guarded instruments of injury to any healthy part. The writer may be forgiven for repeating once more what he has often previously stated, that he has never used an unguarded instrument. But while this is the course of treatment the writer pursues as the result of a long and extensive experience, and one in which he is supported for the most part by that of his hospital colleagues, he is not prepared to deny that brilliant results may be and are daily attained by the use of forceps according to the pattern of Mackenzie, Fauvel, etc. He only thinks that the risk of injury from them is greater than with the snare, and as he has always found the latter in every way efficient, he still continues to employ it almost exclusively. Recently his colleague Dundas Grant¹ has introduced some guarded cutting forceps

¹ Journal of Laryngology, vol. v. p. 482.

which from the experience so far gained promise to combine the safety of the snare with the firmness and grip of Mackenzie's instruments (Fig. 38).

Treatment has been principally directed by the writer to the question of removal by evulsion, but although his own experience is against the employment of escharotics, it is but right to mention that they have afforded good results in the hands of trustworthy and expert observers, notably of

FIG. 38.



Dundas Grant's guarded forceps.

Jarvis,¹ who prefers chromic acid as the best form of caustic, and applies it by means of an ingenious instrument specially devised by himself; sometimes he combines the use of the escharotic with that of the forceps or snare. Nor has notice been taken of the various forms of laryngeal knives which have been invented for the purpose of removing benign growths; such instruments being in the opinion of the writer even more dangerous than the unguarded forceps.

The question of thyrotomy, or division of the external cartilage of the larynx, has not been discussed. It should not be performed except for relief of vital symptoms, nor until an expert has failed to remove the

¹ Transactions of the American Laryngological Association, 1884, p. 69.

growth by an endo-laryngeal operation, for it is very rarely indeed that the voice is much better after thyrotomy than it was before, and the procedure is not without a certain amount of immediate danger to life. The operation has always been more popular with the general surgeon than with the skilled laryngoscopist, but exceptional cases will from time to time occur in which the operation is indicated as the only means of relief. In one such instance under the writer's care, in which there was a ridge-like papilloma attached to the whole length of the vocal cord, no intra-laryngeal treatment would have been successful. It occurred in a child of eight years, and, as respiration was seriously embarrassed, thyrotomy was performed, and with a fairly successful result. Certain foreign practitioners have not hesitated to divide at one operation two or three rings of the trachea, the cricoid cartilage, the crico-thyroid membrane, the thyroid cartilage, the thyro-hyoid membrane, and even the hyoid bone, for removal of a small and non-malignant growth causing but little annoyance; and all this with apparently no thought of such a consequence as perichondritis or caries.

In many cases where there is dyspnoea, the only symptom which appears to warrant interference capable of leading to fatal results, tracheotomy, whether as the sole procedure or as preliminary to other measures, should much more frequently be adopted. In benign neoplasms tracheotomy is sometimes necessary where, the growths being situated on the under surface of or beneath the vocal cords, attempts at removal set up suffocative spasm. In such a case it is better to perform tracheotomy early and at leisure, after a mild warning, than to have to do so as a matter of urgency. After the operation the growths can not unfrequently be removed from below the glottis through the external orifice. The operation is also sometimes necessary in a case of multiple congenital papillomata, as a preliminary to thyrotomy or other procedure. Hunter Mackenzie and others have recorded cases in which, after tracheotomy performed on children on account of dyspnoea caused by laryngeal growths, the tube could be permanently removed at the end of a year, because not only the symptoms but the growths themselves had disappeared without attempts at evulsion.

In performing tracheotomy on account of laryngeal growths in the very young, in whom there is reason to suppose the affection to be congenital, there is a source of danger unnoticed until it was presented in the writer's own practice, namely, that of a congenital pulmonary atelectasis, in consequence of which the rush of air through the tracheotomy-tube, so much greater in volume than the always feeble current through the narrowed glottis, set up a pulmonary apoplexy, resulting in fatal hemorrhage. In this little patient, aged three, the lungs were found post-mortem to be little larger than those of an infant at birth. Lastly, in the light of recent knowledge it may be urged that all obstructions to free nasal respiration should be searched for, and, if found, should be removed prior to endo-laryngeal or other operative procedures.

B. MALIGNANT GROWTHS OF THE LARYNX.

Definition.—A primary and intrinsic laryngeal neoplasm which may be homologous at its commencement, but which subsequently becomes heterologous by extension, and causes death by asphyxia, hemorrhage, or asthenia.

Etiology.—Promise of profit to be derived from a discussion on the probable causes of malignancy may at first view appear as hopeless as the proverbial chastisement of a dead horse; but whilst this may be, to some extent, true with regard to malignant neoplasms in general, an exception must be claimed for those in connection with the larynx.

The chief points for consideration will be,—

First.—Are all malignant neoplasms malignant at their commencement?

Secondly.—If not primarily malignant, can the subsequent malignancy be attributed to (a) either fortuitous circumstances or to (b) certain influences of a constitutional nature, inherited or acquired?

Although the first question is one which may be considered as outside the scope of the present article and as concerning only the general pathologist, it is important to remember that in all parts of the body examples might be quoted to answer the query in the affirmative. For instance, an early removal of an adenoma of the breast is advocated on the ground of its interpretation as a “quiet cancer,” and an ichthyosis of the tongue is treated radically on the anticipatory principle of its ultimate malignancy if not removed. But the second question is one of special interest to the laryngologist.

In dealing with benign growths of the larynx it may be remembered that the writer has referred briefly to the possibility of such new formations, while under observation and treatment, assuming malignancy, not only in a persistence of recurrence, but in an absolute change of histological features. More than twenty-five years' experience has confirmed his opinion that quite a ponderable proportion of malignant growths in the larynx which are histologically innocent in an early state assume a clinical and microscopical malignancy during the course of operative treatment; and, to prevent any possible cause for misunderstanding, it may be said that this malignancy may in some cases be shown only in persistent local recurrence, with development of symptoms of vital intensity, in others by a combination of this feature with actual histological transformation.

Semon,¹ opposing this view, adopted the plan of collective investigation, and as a result has stated that of eight thousand two hundred and sixteen cases of benign papillomata submitted to treatment thirty-two assumed malignant characters,—i.e., one in two hundred and fifty-seven; but since only sixteen were admitted by him (he editing only the opinions of his contributors) to be actually transformed into malignant growths, he has reduced this proportion to one in five hundred and thirteen.

¹ Centralblatt für Laryngologie, etc., July, 1888.

He concludes that if the operation had any appreciable influence in the modification of the neoplasm the proportions would be much more marked ; but such an interpretation may be fallacious in two directions,—first, because the record of a case is mostly determined by its result, and doubtless many which were primarily innocent were finally returned as malignant ;¹ secondly, because until within recent years it has not been by any means a general practice to make a microscopic examination until malignancy was suspected ; and even when made early, there is frequently great difficulty in confirming or dismissing a doubt. This eventuality is one which often occurs in connection with the stratified variety of growth, for apart from the tiny morsels of material upon which the histologist is usually expected to establish an unequivocal diagnosis, the microscopic features may themselves be conflicting even to a skilled pathologist. Without pressing the matter unduly, and making every allowance for errors in observation and for the elasticity of statistics, it should be admitted that laryngeal growths, so far from proving exceptions to the axiom that “a benign growth may become malignant,” are indeed somewhat especially liable to that change.

A very different experience from that of Semon may be deduced from the very frank statistics of Morell Mackenzie,² for with regard to recurrence he relates that out of ninety-three cases treated through the fauces, six recurred which had been entirely extirpated. In three cases in which complete evulsion was effected, the growth after a time underwent further development, and in one case the growth persisted. But this is not all : three out of Mackenzie’s one hundred cases are candidly accepted to have assumed malignancy after having been treated as benign, because repeated microscopic examinations by several eminent pathologists had justified their inclusion in that category.

One case, which was diagnosed as a papilloma,³ was that of a gentleman aged forty-seven, from whom Mackenzie removed several portions by the mouth, but, severe stenosis following, thyrotomy was performed and the growth was radically extirpated. Six months later the patient died from malignant recurrence. Another⁴ was considered by Mackenzie to be a simple adenoma of specific origin, and benign in nature, notwithstanding that a sub-committee of the Pathological Society, appointed to examine the specimen, considered it a case of “adenoid carcinoma.” Nevertheless, the after-history of the case was such that nine years later Mackenzie described and figured it as a malignant growth.⁵

¹ Newman (British Medical Journal, vol. i., 1889, p. 133) feels “assured that if laryngologists were as careful to record their unsuccessful diagnoses as they are to bring forward their accurate ones, it would be found that intra-laryngeal interference with malignant growths had shortened the lives of many sufferers.”

² Essay on Growths in the Larynx, Churchill, London, 1871, p. 97.

³ Op. cit., Case 87, p. 183.

⁴ Op. cit., Case 88, p. 186.

⁵ Manual of Diseases of the Throat and Nose, vol. i., 1880, p. 330.

A third very striking example is one also exhibited at the Pathological Society of London¹ as a papilloma of the larynx, but being attached to the pharyngeal aspect of the cricoid cartilage it has already been considered by the present writer under the more appropriate heading of pharyngeal neoplasms. This growth was believed by Mackenzie to be benign, an opinion which was confirmed by the Morbid Growths Committee, but this also was described and again figured by him ten years later as a malignant sarcoma.²

It was the knowledge of the after-history of these cases as well as of one or two others of the same series—the details of which have not been published—that first awoke the writer's mind to the possibility of the conversion of benign into malignant growths; and all of these occurring in the course of treatment, it was fair to assume that there was a "post and propter" relationship; in fact, the author is not aware of any case of laryngeal neoplasm in which this conversion has occurred in cases not submitted to operation, nor of any method by which such degeneration, if it existed, could be definitely settled except by examination of removed portions.

A fourth case very striking in the direct relationship between the operation and the malignant transformation is reported by Newman.³ A female, aged fifty, suffered from a tumor on the posterior third of the right vocal cord, about the size of an orange-seed, causing little or no discomfort or pain; there was no lymphatic enlargement, and the history of the case favored the diagnosis of papilloma. Dr. Newman was then led to remove a small fragment of the growth, which presented the microscopic appearance of a papillomatous adenoma, *without the least suspicion of the structure of an epithelioma*. Shortly after this he removed a larger portion (histological nature not reported). Following the second operation a diffuse swelling appeared in the neck; seventeen days later this swelling subsided, and revealed two enlarged lymphatic glands, one on each side of the thyroid cartilage. The subsequent course of the case proved them to be carcinomatous in their nature, and the growth within the larynx, which on examination of the first specimen was demonstrated to be a papilloma, ultimately, on examination of subsequent specimens, proved to be an epithelioma, and the patient died from the disease. The reporter, whose exact words have been quoted, deduces from this case the conclusion "that while conscious of the value of removing portions of a laryngeal neoplasm for diagnostic purposes, the proceeding should not be resorted to in cases suspected to be cancer, unless the patient is willing to have a radical operation performed immediately that the diagnosis has been thus completed." But here was a case in which such completion of the diagnosis was supposed to have demonstrated the innocent nature of the growth, of which, moreover, on clinical grounds, no doubt had been previously entertained.

¹ Pathological Society's Transactions, vol. xxi., 1870, p. 51.

² Op. cit., p. 350.

³ British Medical Journal, vol. i., 1889, p. 133.

But the strongest case of all is one related by Semon¹ himself and already referred to under the heading of benign angiomata. In this case the transformation is so vividly illustrated that details of the subsequent history are most instructive, and the more so since they have not appeared in the journal in which the case was first reported. In the opinion of Massei, of Naples, and Malbranc, the growth was "an angioma possibly of ancient date but of recent development." Semon, in his clinical account of the tumor, remarks, "There was no enlargement of the glands in the neck, and no evidence of malignancy; in short, I entirely agreed from what I had read in laryngeal text-books of that extremely rare form of laryngeal tumor,—angioma,—but of which I had never seen an instance, that the growth was in all probability of this character." A supplementary report in another journal² states that the tumor, which on removal by a galvanocautery snare was found to be an innocent papilloma surrounded by blood-clot, recurred four and a half months afterwards, and with the same external appearances. The new tumor was removed in its greatest part *per vias naturales*, and microscopic examination revealed that it was of the same nature as the original, but near the base existed epithelial cones projecting into the tumor.

After Mr. Shattock and Mr. Butlin had pronounced the diagnosis of malignancy, the rest of the neoplasm was removed by sub-hyoidean pharyngotomy. On the evening of the fourth day after the operation, the patient died comatose. Further examination of the tissue removed by the external operation left no doubt as to its malignant nature.

Whether, in this or in other cases, the malignant transformation be the result of irritation caused by more or less partial evulsion, or whether it be that some of the papillomata, adenomata, or angio-myxomata of the larynx are to be classified under the head of "quiet cancers," the fact remains that instances of the malignant conversion of each of these varieties of growths (within the larynx) have been admitted by Schnitzler, Seiler, Seifert, Solis Cohen, Tauber, Wagner, Jarvis, Morelli, Blanc, and others, and to this list of more or less willing adherents to the author's conclusions must now be added the names of Felix Semon and David Newman. But the corollary assumed by Semon to arise from the recognition of such a contingency must not be construed, as he would have it, to be in the slightest degree depreciatory of the value of Von Bruns's introduction of intra-laryngeal operations for removal of tumors *per vias naturales*. On the contrary, even were the percentage of malignant degeneration of benign neoplasms much greater than the present writer himself contends, "the symptoms are," to quote Morell Mackenzie,³ "often so inconvenient, and sometimes so dangerous, that in by far the greater number of cases that come under notice it would still be necessary to adopt measures for the removal of the growth."

¹ British Medical Journal, 1891, vol. i. p. 1127.

² Centralblatt für Laryngologie, December, 1891, pp. 297 and 317.

³ Diseases of the Throat and Nose, vol. i. p. 317.

Apart from the question of a necessarily primary innocence of nature of a laryngeal new formation, it may be well to consider a few influences which may operate in causing or subsequently determining an ultimate malignancy. First amongst them must be discussed the parent of so many ills,—

Syphilis.—In the one hundred cases of benign growth of Mackenzie, at least three were associated with a specific dyscrasia; and in connection with the second¹ one, which afterwards became malignant, as related above, that author himself accentuates the possible dependence of a laryngeal neoplasm upon a syphilitic taint, and this is again referred to by him in connection with another case² in the same series. Two other examples of the connection between syphilis and malignant neoplasms may be related; one under the writer's hospital care was a man aged twenty-eight, who was the subject of acquired syphilis and died from laryngeal epithelioma. The other, now under the care of the writer's colleague, Dundas Grant, is that of a man, aged fifty-nine, with a definite syphilitic history, from whose larynx several portions of benign irritative papillomata have been removed, but in whom the condition at the time of writing has developed into one of undoubted malignancy.

While this evidence is scarcely compatible with Morell Mackenzie's general dictum that "syphilis does not appear to be a factor in the production of laryngeal growths,"³ it certainly justifies a repetition of the writer's view that "syphilis, predisposing as it does to catarrhal inflammation, with a great tendency to hyperplastic deposit, undoubtedly plays an important part in the production of true laryngeal neoplasms."⁴ And this is believed to be equally true of the malignant and of the benign forms.

Tubercle is the only other constitutional state requiring consideration; but the great rapidity with which it runs its course in the larynx minimizes the possibility of its being a likely factor, notwithstanding that it often causes some confusion in diagnosis.

With regard to *sex*, a point arises of no inconsiderable importance, bearing as it does upon habit and occupation. The records of the Central London Throat, Nose, and Ear Hospital afford a proportion of five males to one female, the victims of malignant disease of the larynx. Von Ziemssen⁵ showed that out of seventy-six collected cases sixty were males and sixteen females. Fauvel and Morell Mackenzie also give similar proportions. It is reasonable to assume that this preponderance in the male sex is due, at least in some degree, to habits such as *smoking* and *drinking*, a factor which was well illustrated in Semon's case of malignant growth already referred to. But the greater severity of their *occupations* must also be taken into

¹ Essay on Growths in the Larynx, 1871, p. 188.

² Op. cit., Case 96, p. 194.

³ Op. cit., p. 9.

⁴ The Throat and Nose and their Diseases, 1890, p. 446.

⁵ Cyclopædia of Medicine, vol. vii. p. 891.

consideration ; in connection with which point it is interesting to relate the callings of twelve successive cases occurring in the register of the author's hospital : crossing-sweeper, stoker, car-man, coal-merchant, sailor, blacksmith (two), farmer, laborer, housekeeper, bar-man, undertaker.

The last patient had, in his earlier days, been a cigar-maker, and for twenty years prior to admission for treatment had been exposed to all varieties of weather whilst following his later calling.

There can be very little doubt that these and all other influences which predispose to or excite an irritative hyperæmia of the larynx must be more or less responsible, directly or indirectly, for the establishment of new growths, both malignant and benign. They may also be held to account in some degree for the conversion or arousing of what would otherwise be an innocent growth into a state of malignancy. All this is in accordance with the opinion of Virchow,¹ that persistent irritation of healthy tissues may lead to the formation of heteroplastic growths, an eventuality to which, even without the predisposition of constitutional vice, the larynx of all structures is probably the most liable.

To quote Fauvel,² malignant disease "always respects the larynx." This is true, perhaps not to the extent for which he and others contend, that laryngeal cancer is never propagated by infection to distant organs, but certainly in that cancer which takes its origin at a distant part and may be developed in other regions by metastasis, never thus invades the vocal organ.

With regard to *age*, of the foregoing twelve cases the extremes were forty-six and seventy-one years, giving a mean of fifty-nine, which agrees with the period of life given by most writers as that which is most frequently associated with laryngeal cancer. Sarcomata, however, may occur at any age between four and seventy-four, though they mostly attack young adults.

The question of *hereditary predisposition* is one of no special interest to laryngologists, for although when cancer occurs in other members of the patient's family it may have some bearing upon the diagnosis, its value is but too often discounted by the unreliability of the information supplied.

Malignant growths of the larynx may be conveniently divided into two groups :

1. Epitheliomata.
2. Sarcomata.

All authorities agree that epitheliomata are much commoner than sarcomata, notwithstanding the confusion which has attended the nomenclature of neoplasms. Bosworth,³ in an exhaustive analysis of the records of malignant growths, reported that out of three hundred and thirty-four published cases two hundred and four were cancers and one hundred and thirty sarcomata.

¹ Die krankhaften Geschwülste, Bd. 1. S. 349.

² Traité pratique des Maladies du Larynx, Paris, 1876.

³ Transactions of the International Medical Congress, Berlin, August, 1890.

1. EPITHELIOMATA.

Of epitheliomata (cancers) the stratified or squamous cell-form occurs in the larynx far more frequently than the alveolar, which is extremely rare in this situation,—the records showing a proportion of five to one. The writer's own experience, however, would indicate the preponderance of the stratified variety to be still more marked, and the proportion to be as much as ten to one. This difference may perhaps be accounted for by the fact that only *primary* cases are included in this article.

It may be well here to define clearly the interpretation of the terms *intrinsic* and *extrinsic*, which were originally suggested by Krishaber,¹ since in their application great confusion seems to have arisen. Butlin² defines an *extrinsic* laryngeal neoplasm as one situated on the arytenoid cartilages, the ary-epiglottic folds, the epiglottis, or the sinus pyriformis, whilst that which primarily attacks the vocal cords, ventricular bands, ventricles, and subglottic space is an *intrinsic* growth. This distinction is not only clear, but will be found to be of practical utility.

The histological features of stratified epithelioma of the larynx are practically identical with the pharyngeal examples, and therefore do not demand any special description, having already been considered when treating of malignant disease of the pharynx. Suffice it to mention that the epithelial elements rapidly proliferate, attain considerable size, often become "crenate," and undergo vacuolation; the latter change giving them an appearance not unlike that of an alveolar growth, for which it might readily be mistaken by an unskilled observer.

The growth may commence either as a *diffuse* epithelial proliferation or hypertrophy rapidly invading the submucous tissue and causing a local thickening, so difficult to diagnose in its early stage, or as a *distinct* nodular elevation or projection called by Fraenkel³ "carcinoma polypoides," a form which more readily lends itself to diagnosis.

It may start in any portion of the mucous membrane, but there seems to be a special predilection for the glottic boundaries, which is not surprising, since stratified epithelium is here most abundant and irritation is most likely.

In the majority of cases it is very difficult to affirm definitely whether the actual starting-point is in the ventricular band, the vocal cord, or the ventricle itself, and Morell Mackenzie's figures, which show that only seven cases out of fifty-three commenced in the vocal cords, are somewhat misleading and contrary to the writer's own experience, which indicates a much larger percentage as primarily occurring in the cords themselves. Next to the glottis, in order of frequency, should be placed the epiglottis. The subsequent extension varies greatly with the part which is first attacked,

¹ Gazette Hebdomadaire, 1879, p. 519.

² Transactions of the International Medical Congress, Berlin, 1890.

³ Deutsche Medicinische Wochenschrift, 1889, Nos. 1 to 6.

for should the epiglottis be the starting-point it spreads for the most part into the pharynx, a point well shown in a patient who had just died in hospital under the care of the writer's colleague, Mr. Percy Jakins: the man suffered with an epithelioma of the left edge of the epiglottis, which was shown by the "sectio cadaveris" to have extended to the pharynx, leaving the glottis intact. On the other hand, the skeleton of the larynx is often invaded by malignant ulceration spreading by contiguity from the pharynx (Figs. 39, 40, and 41). This branch of the subject has already

FIG. 39.

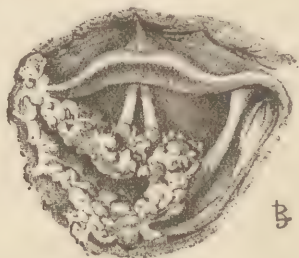


FIG. 40.

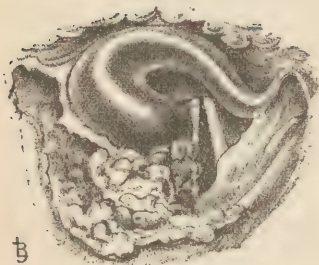


FIG. 41.



Illustrations of cancer of the larynx by contiguity with the pharynx.

received full consideration in the previous article. Newman¹ reports a case—probably unique and of most suggestive interest—in which “the disease clearly spread from the primary growth by direct contagion (auto-infection) rather than, as is usually the case, by contiguity.” When the glottis is the portion primarily affected, the neoplasm generally confines its ravages to the intra-laryngeal structures proper, until the cricoid or thyroid cartilages give way and superficial fungation results.

The implication of the lymphatic glands becomes obvious as soon as *ulceration* commences, for, although infection may have occurred previously, the deposit is seldom sufficient to attract attention until breaking down has taken place.

It has been advanced by Krishaber that *intrinsic* cancer does not affect the glands; by which he doubtless means the superficial ones, a statement which has received support from Semon, Butlin, and Morell Mackenzie, the last of whom affirms that the “external condition of the neck seldom

¹ British Medical Journal, 1889, vol. i, p. 133.

affords any evidence as regards intra-laryngeal cancer." With this view the writer does not agree, for although indications of glandular infection may not be digitally recognized in the very *early* stage, a careful search will always disclose a lymphatic thickening concurrent with the commencement of *ulceration*. The rarity of the cases in which the superficial glands are involved when the glottic or sub-glottic regions are the seats of cancer is easily explained by the circumstance that they empty themselves for the most part into the tracheal glands, which form a lateral series on each side of the tube, and manifest their infection only by paresis of the corresponding cord. But the arrangement of the sub-glottic trunks is of some special interest, and has been fully investigated by Poirier,¹ who has demonstrated that they are from three to five in number, some of which pierce the crico-thyroid membrane and terminate either in the pre-laryngeal gland or in the lateral glands between the larynx and the carotid. This pre-laryngeal gland is present in fifty per cent. of cases examined, and is situated in the space between the crico-thyroid muscles. Should this gland be absent the trunks empty themselves into the lateral glands just mentioned.

The trunks of the supra-glottic region communicate chiefly with the sub-hyoid glands and the lateral glands. This was well shown in a recent autopsy made at the writer's hospital in a case of epiglottic cancer, where the infected glands were so adherent to the carotid trunk that it was impossible to dissect them from the walls of that vessel, whilst the tracheal and pre-laryngeal glands were quite free from deposit.

The paresis of the cord is, in the writer's opinion, of even greater value for diagnostic purposes than a microscopic examination of a fragment; and in a certain illustrious case had this clinical feature been published when it was recognized, the report of benignity as furnished by the microscope would have received much less acceptance than was given to it.

The laryngoscopic appearances in the early stage of an epithelioma are extremely equivocal and tax to the utmost the diagnostic powers of the observer. There may be either an ill-defined thickening of the mucous membrane, or a distinctly nodulated sessile tumor giving the impression of a papillary overgrowth of a white or pale rose color when starting from the cords, but of a deeper tint when situated elsewhere. Although this growth generally *appears* to start from the cord, experience shows that in reality it often originates in the ventricle. As the disease progresses, the color becomes more pronounced, and at one or more spots may be seen foci of ulceration, whilst the corresponding cord becomes more or less fixed either from hyperplastic deposit limiting the movements of the arytenoids or from infection of the peri-tracheal glands involving the recurrent laryngeal nerve. Subsequently the whole mass may present a large irregular sloughing surface, covered with purulent secretion more or less abundant according to the extent to which the cartilages are involved. There is,

¹ *Annales des Maladies de l'Oreille, du Larynx, etc.*, May, 1887.

however, nearly always profuse reflex salivary secretion which is inconvenient alike to the patient and to the laryngoscopist. The *external* evidence may or may not be marked: this will depend upon infection of the superficial glands or the extent to which the growth has distended the thyroid plates, for fungation to the surface is extremely rare; consequently palpation does not often furnish a safe criterion of the amount of the intralaryngeal ravages.

Symptoms.—These will naturally vary with the situation of the primary lesion.

Articulation and *speech* will be markedly affected in the intrinsic form; should, however, the epiglottis only be primarily involved, beyond a somewhat "throaty" character, speech may be normal, but so soon as infiltration involves the glottis, phonation will be at once imperfect either from mechanically interfering with the cords or cartilages or from paresis of their muscles due to infection of the tracheal glands. Actual aphonia is a late symptom, although hoarseness may have persisted from an early date.

Embarrassment of respiration quickly follows impairment of the voice, especially in the intrinsic form, dyspnoea being often produced by comparatively slight exertion even when the disease involves only one side of the larynx, an indication that either the muscles or their nerves are involved. In later stages severe paroxysms of inspiratory dyspnoea may occur as the result of glottic stenosis or of one or other of the above-mentioned complications.

Cough is not a prominent symptom of malignant disease of the larynx until ulceration is well established and the sensory fibres of the superior laryngeal nerve are involved; then, however, the patient may be attacked by severe explosions, accompanied by the expectoration of masses of necrosed tissue or by even (occasional) profuse hemorrhages.

The last-mentioned symptom is surprisingly rare according to most authorities, although traces of blood are quite common. These give a rosy pink character to the sputum which, in combination with microscopical evidence of cell nests and other structural elements, constitutes an important factor in the diagnosis. Another sign of importance is *fœtor*, and it has been truly remarked that the nose rarely deceives in a question of cancer.

Deglutition is not materially affected except in the later stages of intrinsic disease, but *dysphagia* and *odynphagia* are invariably associated with all periods of the extrinsic form. The almost persistent frothing up or dribbling of saliva in this latter variety is a circumstance which almost excludes the diagnosis of syphilis, but is one which is common also to tuberculosis.

At all times *pain* is a constant symptom, as it is with malignant disease in other parts of the body. It is not always referred to the larynx, but may be located in the pharynx, neck, and ear, the latter situation occurring so frequently as almost to be considered a constant phenomenon; yet its diagnostic value *per se* is not great, for a similar phenomenon invariably

attends a laryngeal tuberculosis, whilst in syphilis it is the exception. Von Ziemssen's view that it positively indicates laryngeal cancer must therefore be qualified. Pain in intrinsic cancer is not an early symptom, but in the extrinsic form is more constant. It is often relieved by the fresh breaking down of recent extensions of infiltration or by hemorrhages, but as the ravages of the disease increase agony may be constant and extreme.

The general symptoms are those which are associated with the so-called "cancerous cachexia," but which are simply indications of a rapid *marasmus* and *asthenia*, combined with interference with the vital functions inevitable from the site of the growth. But it may happen that indications of waste are not marked till a very advanced period of the disease. This is especially apparent in the intrinsic forms in which there is not impairment of the function of deglutition. Severe anæmia is not often prominent, but an icteric tint is often seen in the course of malignant disease in the larynx as in other regions, and this has been held by many observers to indicate an hepatic metastasis.

The *diagnosis* in the early stage is by no means easy, for even should there be a distinct tumor a doubt may arise, through its simulation of a benign growth, which the microscope does not always clear up; and when occurring as a diffuse form the differentiation from syphilis, tubercle, or even lupus, may task the acumen of the laryngoscopist to its utmost, and a positive opinion can often be given only after an exhaustive trial of anti-syphilitic remedies and a careful consideration of all the details in the clinical history and phenomena.

Prognosis.—This will depend to a great extent upon the nature of the growth, for epitheliomata of the stratified variety spread rapidly, whilst the alveolar are much less active, Mackenzie stating that three years is the probable duration of an encephaloid.¹ In those cases in which the disease is reputed to have lasted several years primary malignancy may reasonably be doubted. However carefully the epithelioma may be removed, death generally occurs within twelve months.

How far removal—partial or complete—influences the prognosis may be an open question; but the writer's experience has shown that the comparative results of thyrotomy or thyrectomy and of simple tracheotomy are much in favor of the latter.

The average duration of the disease in twelve successive cases at the writer's hospital was eleven months; but a recent case of extrinsic epithelioma of the epiglottis in the same institution lasted only three months, the patient dying of starvation.

The possibility of a radical cure is so remote that it need not be entertained. Death may result from asthenia, asphyxia, or hemorrhage.

Secondary deposit in distal organs is not common, the most frequent seat

¹ Diseases of the Throat and Nose, 1880, p. 341.

being tracheal and bronchial glands and the lungs; but even the liver, kidneys, and adrenals may be infected.¹

Alveolar epithelioma (adenoid, scirrhous, or encephaloid cancer) is a form which may be considered so extremely rare in the larynx that a very short account will suffice.

The structure has already been detailed when treating of malignant disease of the pharynx; and the laryngeal variety presents no specially distinctive features.

It doubtless commences in gland-tissue of the acino-tubular type, such as the mucous and albuminous, found so plentifully in the laryngeal sacculus and the epiglottis. Probably it arises in the first instance as an adenoma in which the intra-alveolar cells have multiplied and, becoming extra-alveolar, have thus assumed a microscopic malignancy.

As a rule, the growth is rapid, but less so than in that of the stratified variety; it soon involves the lymphatics, and has a great tendency to secondary deposits in other organs.

The few recorded cases show that the epiglottis is the most frequent seat, so that it is rarely intrinsic. In the early stage this form of epithelioma often simulates a benign growth, but ulceration is soon established and is followed by a luxuriant sprouting of nodules, which in turn undergo ulceration. These vegetations seem to spring from the centre of the tumor, and have but slight tendency to burrow in the surrounding mucous membrane, a sequence in strong contrast with the stratified form, which spreads peripherally.

The *symptoms* and *diagnosis* are for the most part identical with those of the stratified form, but the *duration* is somewhat longer.

2. SARCOMATA.

The comparative rarity of this form of laryngeal neoplasm is extremely difficult to account for upon clinical grounds; it is, however, probable that the histological records are faulty, and that a more careful nomenclature, based upon the actual cell-structure seen, may in the future furnish more valuable and less ambiguous statistics upon so important a point.

A sarcoma is a malignant growth developed upon the type of a connective or meso-blastic cell-tissue: hence the numerous modifications of the simple round and spindle cell forms. In the larynx, however, the only varieties recorded are: 1, round-cell sarcomata; 2, spindle-cell sarcomata; 3, chondro-sarcomata; 4, myxo-sarcomata.

The *spindle-cell* form is generally considered the most malignant, from the great tendency which it shows towards multiplicity, whilst the other varieties may last many years and may even be cured.

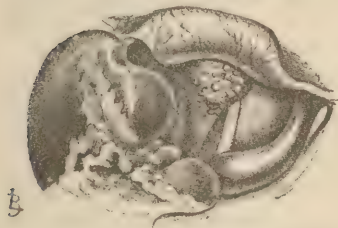
According to most text-books, sarcomata rarely infect the lymphatic glands; this is a view with which the writer does not agree, for in each of

¹ Lennox Browne, *The Throat and Nose and their Diseases*, 1890, p. 474.

his cases the infra-hyoid and other glands were distinctly involved. Doubtless in sarcomata as in epitheliomata the infection rarely occurs prior to ulceration, except in the round-cell form, when it may be found quite early in the disease.

The intrinsic form is far less common than the extrinsic, for of six recent cases two commenced in the ary-epiglottic folds, one in the epiglottis, one in the arytenoid cartilages, one from the cricoid, and only one in the vocal cord. It is, however, extremely difficult to determine whether in cases seen

FIG. 42.



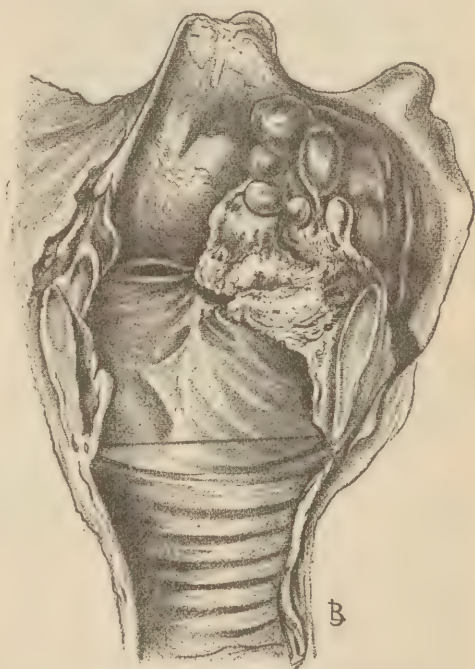
Laryngoscopic appearance of a sarcoma.

in an advanced stage the disease has originated within or without the laryngeal boundaries. This circumstance is well illustrated in the accompanying figures, 42 and 43, showing the appearance during life and on section after death.

Sometimes the growth may arise as a secondary extension from the tonsil, as was observed in a case exhibited by the writer in 1887: the left tonsil was enormously enlarged and protruded far across the right of the middle line (Fig. 44); on passing the finger down the throat the growth was found to be attached to the epiglottis and to extend downward between the palato- and glosso-pharyngeal muscles as far as the hyoid fossa. A laryngoscopic view was possible only after removal of the tonsillar growth.

The laryngoscopic image will vary widely according to the size, the situation, and the rate of development. Accompanying the growth there is generally some infiltration of the surrounding tissues; but although the tumor may greatly displace the larynx the movement of the vocal cords is not often impaired till a late stage, doubtless owing to non-implication of the recurrent laryngeal nerves before ulceration has infected the tracheal and other glands. This is well exemplified in Fig. 45, which represents the laryngoscopic appearance in a merchant captain, aged sixty-one, sent to

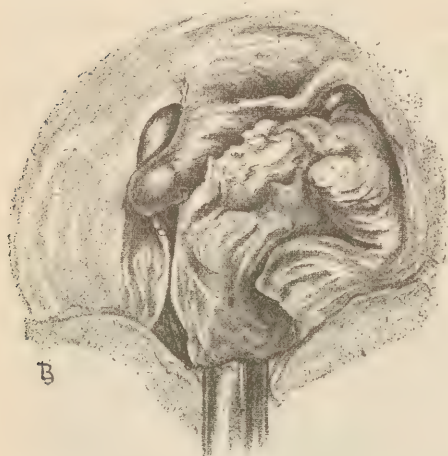
FIG. 43.



Post-mortem appearance of the same case.

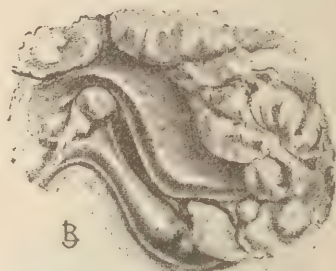
me for a corroborative opinion by Dr. Middlemas Hunt, of Liverpool, so recently as June 7, 1891.

FIG. 44.



Sarcoma of the tonsil.

FIG. 45.



Sarcoma of epiglottis and larynx in the same case.

The patient, who denied any history of syphilis, was the father of eight healthy children ranging from twenty-seven to thirteen years of age. He

had been both a free drinker and smoker, and had first suffered from great prostration some eight months before, but symptoms of dysphagia, dysphonia, and dyspnoea with sanguineous expectoration dated only two months previous to his visit to me.

On external examination the tissues covering the whole region of the larynx were greatly infiltrated and of stony hardness, especially the thyroid group of glands on the left side, which were moreover very tender to touch, and the thyroid notch was felt to be pushed over an inch to the right side of the middle line of the throat. As the drawing shows, glottic stenosis was extreme, and but little air was entering the left lung.

From the fact that the general *signs* and *symptoms* indicate a malignant disease of the larynx, the chief points in forming a *diagnosis* will be found in the age of the patient, the rate and size of the growth, and the physical characters, aided by, whenever possible, the microscopic examination of a portion of tissue. In the case of a chondro-sarcoma, the stony hardness of the swelling combined with the late establishment of ulceration will help to indicate its nature.

The *prognosis* must necessarily be grave: still, the anticipation of life is somewhat longer in sarcoma than in epithelioma, unless it be of the round-cell variety, or when attacking the very young.

A boy, aged nine years, who was under the writer's care suffered with a round-cell sarcoma commencing in the ary-epiglottic region which eventually killed him in two years, after attaining a considerable size.¹ In another case,

¹ The Throat and Nose and their Diseases, 1890, p. 477.

that of a woman,¹ aged forty-nine, the patient succumbed in about twelve months; the tumor consisted of round and spindle cells; whilst a case of chondro sarcoma lived only four months after the date of the first symptoms.² In those cases which have been reported as cured, it may be questioned whether the period of subsequent watching was sufficiently long to justify such a statement, but there are not wanting cases in which *complete* extirpation has been followed by an equally complete immunity against recurrence.

Considering the subject of laryngeal cancer as a whole, and especially its treatment, the author finds no reason to change the opinions and recommendations which he has enumerated in various editions of his systematic work.

In the first place, it has to be remembered that malignant disease of the larynx, if unchecked by operation, is universally fatal; but its course varies considerably, according to its original site and pathological nature. *Small round-cell sarcomas*, when occurring within the larynx, grow slowly, and exert the least amount of constitutional cachexia; when manifested as an extension from the tonsil, progress is more rapid. (Figure 46.) *Spindle-cell myeloid sarcomas* exhibit increased malignancy. *Epithelioma*, whether stratified or alveolar, kills more rapidly than either when once in a state of active development,—that is, of new growth or of ulceration,—but it would appear in some instances to lie long dormant. It much earlier affects the general health of the patient than a sarcoma, attacking as it does the vital mechanisms of respiration and deglutition.



Sarcoma of the larynx.

It would appear possible, from the result of at least one case (the celebrated one of Bottini), to completely eradicate *sarcoma* by extirpation. In others of a similar pathological nature comfortable life has been prolonged for some years; but the outlook of such attempts in the case of *epithelioma* is very unfavorable, for, however complete may appear the removal, recurrence is sure to take place sooner or later.

The direct causes of death are much the same as those occurring in malignant disease in those situations of the throat previously considered, and whatever the variety of malignant neoplasm encountered, the surgeon will bear in mind that life may terminate by marasmus or asthenia, asphyxia, or hemorrhage; or by secondary diseases, as pneumonia, or through perforation of the cesophagus.

Treatment.—Remedial measures may be divided into (1) medical, (2) surgical, and (3) hygienic.

1. As to the first, no drug of which there is present knowledge has the

¹ Op. cit., p. 481.

² Op. cit., p. 814.

least effect on the career of laryngeal malignancy, whatever the circumstances of site or variety, and it is only waste of time to discuss the supposed efficacy of Chian turpentine, mercury, arsenic, sulphide of calcium, iodoform, or ergot. Constipation is a frequent symptom of cancer in the larynx as of other regions, and relief of that state by enemata or otherwise should not be neglected. For the alleviation of pain, local applications of ethereal solutions or of insufflations of iodoform, iodol, aristol, morphia, or cocaine are to be advocated; while externally, belladonna, chloroform, etc., and continuous heat by the warm coil, are each of more or less service in mitigating agony. Lozenges of cocaine, morphia, or codeia are not of much use in laryngeal disease; but sedative inhalations of benzoin, chloroform, or conium give occasional relief to the inflammation; detergent and antiseptic gargles, especially when used by the Von Troeltsch method, tend to diminish the annoyance of excessive salivation, and to sweeten the sense of taste and the odor of the breath. Ear-drops of laudanum and belladonna are of great value in diminishing the constant and wearying otalgia.

One practical point which should never escape the notice of the surgeon in the treatment of these cases is reserved for the conclusion of this section,—namely, the possibility that, in spite of apparently decided symptoms, both functional and physical, the disease may be due to the syphilitic dyscrasia; and it must still further be remembered that the one does not necessarily exclude the other. It is a good rule, therefore, to give antisyphilitic remedies, especially iodide of potassium, or preferably iodide of sodium, at the commencement of the treatment; care being taken lest the error be made of mistaking the improvement, which so often occurs in the first few weeks of such a course, for a prognostication of cure.

2. *Surgical measures* include (a) endo-laryngeal attempts at removal, (b) endo-laryngeal cauterizations, (c) tracheotomy, (d) complete extirpation, and (e) partial extirpation or resection.

Consideration of the advisability of operative procedures is always sure to be pressed upon the notice of the surgeon, since both the patient and friends are naturally anxious that the obstruction to deglutition should be removed, and that the life-threatening dyspnoea should be relieved. There can be no objection to operative measures, provided it be well understood on both sides that the relief, though it may be considerable, is in all probability but temporary, and that the inevitable termination will only be postponed.

The degree of danger involved, as well as the amount of benefit to be expected from the various operations just mentioned, will now be considered separately.

(a) Possessed of a strong conviction that malignancy may be engendered by repeated removals of a (microscopically) benign growth manifesting rapid recurrence, the writer cannot counsel *endo-laryngeal* attempts at removal of either a sarcomatous or an epitheliomatous neoplasm, the pathological nature of which has been demonstrated by competent examination of a

portion experimentally detached. In this view somewhat unexpected support has been received from Newman,¹ who is probably justified in his deprecation of the removal even of a fragment for histological confirmation of an otherwise provisional diagnosis, unless the patient be willing to have a radical operation performed immediately that the malignant nature of the growth is verified.

Looking to the natural history of a *sarcoma*, and the decidedly unsatisfactory results of attempts to eradicate it by operation from such easily accessible situations as the tonsil, it is not probable that any procedure of the same nature lower down in the throat would be of permanently good effect; and the same objection obtains with even greater force in the case of *epithelioma*. One is obliged, therefore, to share in the general scepticism with which reports of "cures" resulting from endo-laryngeal operations for malignant disease are to be regarded. An exception must, however, be made in favor of the brilliant success which has rewarded the skill and perseverance of B. Fraenkel² in the following case:

The patient, seventy years of age, had a tumor on the right vocal cord of the size of a bean. This was extirpated by the cautery loop. Microscopically it proved to be a carcinoma. A year later it recurred, and was again extirpated. During the next three years there were three recurrences, with extirpation after each. A carcinomatous gland of the neck was also removed by Professor Madelung. The patient, at the time of the report, was seventy-five years of age, and for two years the larynx had shown no signs of any neoplasm. The voice was clear and loud. Such an instance of complete eradication is probably unique, but Stoker has reported a similar one in which recurrence has not yet taken place after an interval of two years. In this case, however, the voice has been for some time failing, there is considerable thickening at the site of the growth, the general health is impaired, and recurrence appears imminent.

(b) The cases just referred to might be considered as included in the category of an *endo-laryngeal cauterization*, but this term is preferably reserved for applications of the galvano-cautery to malignant ulcerations and infiltrations which do not admit of extirpation. Such a procedure has twice been adopted with advantage by the writer, once in an epitheliomatous ulcer of the epiglottis, and once in a sarcoma extending to the same region from the tonsil; but experience has taught that the benefit of such a measure is but temporary. With regard to its adoption for laryngeal disease at a lower level, the concluding remarks of a paper read at the International Medical Congress of 1881 may be quoted:

"While without the galvano-cautery in diseases of the nose, pharynx, mouth, and tongue, I should feel deprived of at least one-half my power to help the conditions for which I use it, I have a strong conviction that

¹ British Medical Journal, 1889, vol. i. p. 133.

² Langenbeck's Archiv für klinische Chirurgie, Bd xxxiv., Heft 2; and Journal of Laryngology, vol. i., No. 2, p. 67.

were I to employ it to such regions as the larynx below the epiglottis, to the pharynx below the same level, or to the œsophagus, I should introduce into my practice a new and grave element of danger."

The employment of any other form of caustic, as the traditional nitrate of silver, is futile; while those of a more active character, such as chromic acid, acid nitrate of mercury, and trichloroacetic acid, are attended by risks out of all proportion to any possible chance of benefit.

Electrolysis, in the author's hands, has given such favorable evidence of its solvent powers in cases of meso-blastic growths in the palate and fauces that it is worthy of more extended trial in the larynx, though probably the cases suitable for its application will always be restricted in number. It must not, however, be forgotten that this measure is strongly contra-indicated in epitheliomata, in which the only effect would be to aggravate the intensity of the disease.

(c) The operation of *tracheotomy* is attended with very considerable prolongation of life, but it is of course only provisional against dyspnoea, and palliative of the same vitally serious symptom. Fauvel's statistics from his own experience of this operation are very valuable; they show that in the most frequent form of malignant diseases—epithelioma—the average duration of life of seven patients on whom *tracheotomy* was performed was *four years*; whereas *six* patients suffering from the same disease, who were *not* submitted to this operation, lived only on an average *twenty-one months*. *Eight tracheotomized* patients, suffering from encephaloid cancer (? sarcoma) of the larynx lived an average of *three years and nine months*; while seven, *not tracheotomized*, survived on an average *three years*. Looking at the fact that by such an operation the vital symptom of dyspnoea is relieved, and that further measures by galvano-cautery, etc., are rendered more easy and more safe, these figures may be taken as demonstrating, in the words of Fauvel, "*the utility, not to say the necessity, of this operation.*" In one case of intrinsic epithelioma—diagnosed by microscopical examination—under the care of my colleague, Dundas Grant, the patient lived for nearly three years in greatly-increased comfort. For some months after the operation she even gained in weight. Such an experience is by no means unique.

An important element in considering the question of any operation on the larynx for malignant disease is the determination, as far as possible, of what we have to deal with,—that is, whether with an epithelioma—*cancer*, in fact—or with a sarcoma. Cancerous growth, if it can be called growth,—perhaps it would be better to say the cancerous process,—has, within each of its constituent elements, *intrinsic* decay, which commences almost from the date of its birth. A sarcoma, on the other hand, represents an unlimited repetition of cell-growth, which decays by the ordinary process of inflammation; in other words, either from *extrinsic* irritation or from the new growth increasing beyond the power of the vascular and nervous supply to sustain living.

In a case, therefore, of supposed malignant disease of the larynx, and especially if the respiratory mechanism be impaired, no good purpose is subserved by delay, for supposing even that the diagnosis should haply have been made of a graver malady than the after-history confirms, and the canula may in time be even dispensed with, not only would no harm have been done, but, on the contrary, there would have been a gain to the patient, if only in the saving of the muscular force wasted absolutely in dyspnœic breathing. This is a consideration but too often neglected, except in the case of paralysis, in which it forms, according to all writers, the chief, and sometimes an exceptional, argument in favor of an early tracheotomy.

In view of the possibility of extension of the disease, tracheotomy, unless made as a preliminary to more radical measures, should be performed as low as possible in the windpipe; for Cohen reports that "the recurring growth may force its way to the exterior through the wound, or, as he had seen after low tracheotomy, it may rupture an intact crico-thyroid membrane, and split the thyroid cartilage to give exit to its outgrowths." In tracheotomy as a preliminary to extirpation, the high operation in the second or third rings is preferable.

(d) The operation of *complete extirpation of the larynx*, though not for carcinoma, was performed by Patrick Heron Watson,¹ of Edinburgh, so far back as 1866, and was not repeated till 1873, when Billroth² adopted the same measure for the disease under present consideration. This patient died from recurrence seven months later. Five cases followed, one of which was again under Watson;³ one (Heine⁴) terminated with recurrence in six months, and all the others in a few days. Then came the celebrated case of Bottini,⁵ who, in 1875, removed the entire larynx on account of a mixed sarcoma. The patient was alive and pursuing his occupation ten years after the operation. Since then the operation has been frequently performed, and there are now over one hundred recorded cases, the statistics of which have been frequently detailed. No one has taken such pains to investigate the subject with thoroughness and completeness as Solis Cohen,⁶ and the writer is much indebted to his tables for valuable and recent information.

"From the records referred to and from study of some of the reports in detail, it appears evident that complete laryngeotomy can be performed without sacrifice to life, but that every operation places life in peril, and that a large number of the patients succumb within a period so brief that their early death is attributable to the operation and to nothing else. Of

¹ Transactions of the International Medical Congress, 1881, vol. iii. p. 255.

² Archiv f. klinische Chirurgie, Bd. xvii. S. 343.

³ Transactions of the International Medical Congress, 1881, vol. iii. p. 255.

⁴ Archiv f. klinische Chirurgie, Bd. xix. S. 584.

⁵ Transactions of the Royal Academy of Medicine, Turin, April 30, 1875.

⁶ International Cyclopædia of Surgery, vol. v. p. 770, New York, 1884.

the deaths reported (to May, 1884, ninety-one in all), twenty-six occurred within the first eight days, and five more within the second eight days,—more than one-third of all the patients subjected to laryngectomy having thus succumbed within little more than a fortnight. The most usual cause of death in this period is from pneumonia, and the period of danger from this event does not seem to exceed two weeks, unless the conditions are exceptional. This important fortnight of tribulation safely bridged, the life of the patient may be regarded as tolerably secure up to the fourth month. Then death from recurrence begins to be imminent, and, according to circumstances, will take place within an additional period varying from a few weeks to several months, or to more than one year. Complete laryngectomy involves great risk of death by pneumonia, future respiration through an artificial aperture, temporary nourishment by the stomach-tube, and possibly utter inability to speak without the aid of an artificial substitute for the larynx, adjusted to the tracheal canula.” More recent statistics are those of Eugene Kraus of Vienna,¹ and are much to the same effect as Cohen’s. Of one hundred and sixty cases of total and eighty of partial extirpation (not all of the operations being for the relief of cancer), “cure” is reported in the proportion of twenty-nine per cent. of the complete extirpation, and eighteen per cent. of the partial; while the immediate fatality is stated to be forty-two and forty-three per cent. respectively. The average extension of life in one hundred and eight cases was two and a half months. These figures contrast very unfavorably with those to be obtained by tracheotomy alone.

Cohen’s and Kraus’s conclusions are here quoted in preference to those of the author, because his well-known views as to undue rashness in endolaryngeal operations might be held to prejudice his opinions on this question also. But when, some ten years ago, the late Dr. Foulis, of Glasgow, showed at the Medical Society the patient from whom he had successfully extirpated the whole larynx four months previously, for “papilloma and spindle-celled sarcoma,” he ventured to express a doubt whether that operation would ever yield beneficial results commensurable with the immediate danger of its performance, the very short extension of life, and the discomfort of an artificial larynx to those who should survive long enough to wear one; and he drew attention to the superiority of the statistics of tracheotomy to those of the radical operation. Dr. Foulis’s was the eighteenth complete extirpation, and the second which survived more than nine months, for his patient lived a year and a half, and death ultimately resulted from phthisis.

Nevertheless, for the honor of British surgery, it is gratifying to be enabled to state that not only was this courageous procedure first adopted by a British surgeon, as already recorded, but that generally the success in this country has been equal to that of Continental operators. Thus, Foulis²

¹ Allgemeine Wiener Medicinische Zeitung, April 15, 1890.

² British Medical Journal, May 7, 1881, and May 8, 1886.

operated on a second patient in April, 1881, who survived *nine months*. In the case of a patient operated on by Whitehead,¹ of Manchester, in May, 1882, that surgeon reported that he lost sight of his patient, but that he was well *twelve months* afterwards. Jones,² of the same city, had a case in April, 1884, which survived *nine months*; and Newman,³ of Glasgow, successfully removed the larynx on February 6, 1886, from a man aged thirty-seven, who in March, 1887, *thirteen months* after, was well and "able to follow his occupation."

On the other hand, the operation has been performed in this country, as on the Continent, somewhat unjustifiably for cicatricial stenoses and for benign formation, and also under very adverse circumstances, namely, without requisite precaution, in the shape of a proper tampon-canula, against introduction of blood into the trachea, and even without a preliminary tracheotomy. It has also been performed on more than one occasion, in response to an urgent request of the patient, without regard to any abstract question of favorable statistics. But, however all these points may be viewed, the general results are so discouraging that many surgeons who have performed the operation have resolved never to repeat it, while others have adopted measures less hazardous.

(c) Of these less dangerous operations, *partial laryngectomy*, in the form of removing a lateral half, stands in the first rank. The risk of pneumonia is less, exposure of the pneumogastric being confined to one side instead of both; indeed, if the raspatory be used for the removal of soft parts, as in my practice, the nerve need not be exposed at all. The danger of pneumonia in its septicæmic form, as the result of blood entering the lower air-passages, has been still further lessened by introduction of the compressed sponge tampon-canula, which is an immense advance on the india-rubber inflating tampon-canula of Trendelenburg. For this improvement—as also, indeed, for general acceptance of the operation—the profession is indebted to Eugene Hahn,⁴ who had already great success with complete extirpation, and has since recorded several instances of partial removal with equally happy results. There are now recorded some *thirteen or fourteen* cases, and in only *one* instance has there been an *immediately fatal* result. The operation possesses the following additional advantages: deglutition is not impaired, an artificial larynx is not required, nor even, after a few days, a tracheotomy-tube, and a very fair and serviceable voice is generally restored.

Recurrence must, in the nature of things, be always anticipated; and we have yet to see what sort of history cases will have in this respect. So far there is reason to expect that the operation may afford average periods of

¹ Lancet, November 4, 1881, p. 741; and communication to author, February 28, 1887.

² Ibid., August 2, 1884, p. 191; and communication to author, February 28, 1887.

³ British Medical Journal, May, 1886, p. 868; and communication to author, February 28, 1887.

⁴ R. Volkmann's Sammlung Klinischer Vorträge, Leipzig, 1885.

immunity from recurrence, even of the more serious forms of malignant disease, almost, if not quite, equal to those provided by tracheotomy. It is earnestly to be hoped that care will be taken in the selection of subjects for this operation, as otherwise discouragement will be given to its performance where other circumstances would be favorable.

Partial laryngectomy has been advised for unilateral and intra-laryngeal epithelioma, and in recent non-infiltrating sarcoma. It is useless in pharyngo-laryngeal epithelioma, in which the larynx is invaded from the pharynx, and whenever there is implication of the cervical glands and structures adjoining the larynx. It is always possible, if on division of the thyroid cartilage the disease is seen to have extended beyond the limits suspected by prior examination, for the surgeon to desist from removal, and to be content with having performed a palliative tracheotomy.

This question, whether intra-laryngeal cancer can be best treated by a palliative tracheotomy or by attempts at radical extirpation, is still *sub judice*, though the writer's views are certainly in favor of the former. To arrive at a fair verdict every case of laryngectomy and thyrotomy should be fully recorded.

A case in the writer's practice was published¹ at a period long prior to the time at which the real issue, that of immunity from recurrence, can be settled, because he believed that the difficulties of the operation, and also its immediate dangers, have been largely exaggerated.

It may just be said that the special dangers are those of hemorrhage and of secondary pneumonia. The abridged account of the case which now follows points out in the most practical way the various steps of the operation and the special precautions which were adopted to avoid hemorrhage,

the fear of which has been so great that in one case (of complete extirpation) Langenbeck was obliged to tie forty arteries.

The patient was a man aged sixty-one, occupied in a timber-yard, who applied at the hospital as an out-patient, November 1, 1886, on account of hoarseness of voice, and occasional tickling cough first noticed about two years ago; he had never suffered pain, or anything approaching inconvenience in breathing, except when hurrying to catch a train or omnibus.



Epithelioma; laryngoscopic view.

The patient was a hale-looking man for his age, five feet six inches in height, and weighing one hundred and sixty-six pounds. The laryngoscope showed that, while both vocal cords were congested, the left cord was immobile and ulcerated at its posterior portion. There was at that time but little thickening of the left ventricular band, and of the tissues of the left

¹ British Medical Journal, February 5, 1887.

laryngeal boundary of the pharynx. There was neither then, nor indeed at any period, involvement of the cervical glands, nor was there any constitutional symptom pointing to malignity. Anti-syphilitic treatment pursued for six weeks failing to arrest the ulceration, and there being decided diminution in weight, it was decided, after consultation with colleagues, to attempt removal of the diseased half of the larynx, and, the patient being admitted to the hospital December 13, the operation was performed on the 15th.

The operation, which lasted an hour and a half in all, may be conveniently divided into four stages :

(1) A *high tracheotomy* between the second and third rings, and the introduction of Hahn's tampon-canula, consisting of a tube surrounded by compressed sponge. This was first dipped in a solution of corrosive sublimate (one in five thousand).

(2) An *interval of twenty minutes* for expansion of the tampon, anæsthesia being maintained by the administration of chloroform through the tracheal tube.

(3) *Thyrotomy*.—The median incision was extended from just above the tracheal opening to the lower margin of the hyoid bone, and all the tissues were carefully divided on a director until the thyroid cartilage was reached. The soft parts over the thyroid and cricoid cartilages were rasped sub-perichondrially, the raspatory being kept so close that the perichondrium was literally peeled away from the cartilage, whilst its relation to the superficial soft parts remained undisturbed. The separation was carried back by this means as far as the median line of the boundary between the larynx and pharynx ; no scissors, knife, or other instrument than the raspatory was used. A horizontal incision over the hyoid bone, as recommended by Hahn, was not necessary, the vertical one proving amply sufficient, but part of the hyoid attachment of the thyro-hyoid muscle was severed. The much-ossified thyroid cartilage was then divided by cutting forceps along its centre, the wings were separated by retractors, and the growth was seen to be confined entirely to the left part of the larynx, which portion it was decided to remove.

(4) *Laryngectomy* was effected by (a) further careful and thorough separation of the attachments to the pharynx by raspatory, knife-handle, and finger-nail ; (b) division of the thyro-hyoid membrane as close as possible to its thyroid attachment ; (c) division of the left superior horn of the thyroid cartilage at its root by cutting pliers ; (d) division in the median line of the cricoid cartilage before and behind with pliers ; (e) the divided half of the larynx was then separated from the first ring of the trachea, and a few nicks only were necessary to remove it entirely.

The following points regarding the operation are worthy of note. Hemorrhage, the extent of which is usually described as serious, was, in point of fact, quite trifling ; only two small vessels required torsion in the second stage of the operation. Not only were no vessels searched for, as recommended by most writers, but none of any size were exposed, this happy

circumstance being doubtless due to the use of the raspatory in preference to scalpel or scissors, and also to keeping so close to the cartilage. The soft parts were little disturbed in consequence. To this procedure is attributed a very large measure of the success of the operation in its immediate and subsequent circumstances. The slight oozing which ensued after the removal of the diseased portion of the larynx was checked by a light application of the galvano-cautery along the margin of division. This procedure was also adopted for the purpose of destroying any possible fragments of diseased tissue not removed. The left ary-epiglottic fold was divided close to the cartilage of Wrisberg, and the thyro-hyoid membrane close to its thyroid attachment, with the view of impairing as little as possible the action of the epiglottis. The success of this plan was completely shown in the ease with which deglutition was effected three days later. No spray was used; but antiseptic precautions were adopted by the operator, assistants, and nurses first bathing their hands in a solution of perchloride of mercury one in five thousand, and by the cleansing and rinsing of all instruments and sponges in a similar solution.

The patient made an excellent recovery, with but one relapse of a few days, due to carelessness of the nurse. He was fed with a tube for the first three days, but seventy-eight hours after the operation the patient was ordered a mutton-chop to eat, according to the treatment of Hahn, who for obvious reasons recommends solid food as the first to be given by the mouth. On Christmas day, the eleventh from the operation, he had turkey and champagne for dinner, and from that date convalescence was uninterrupted.

He "got up" for the first time on the seventeenth day after operation. The tracheal tube was removed on the twentieth day,—that is, on January 3. His weight was then one hundred and forty-eight pounds, being a loss of twelve pounds since the operation.

Examination of the growth after removal (Fig. 48) showed it to have sprung from the ventricle, and not from the vocal cord as had been diagnosed on laryngoscopic examination, in this respect resembling, both in its site and in the misconception, several cases reported by other surgeons. The extent of the disease was so far greater than had been suspected prior to operation; this circumstance of the case

FIG. 48.



Epithelioma of larynx; left wing of thyroid, left half of cricoid, and left arytenoid cartilage, showing extensive area of new growth.

illustrates the very foreshortened view, with consequently incomplete diagnosis, which may sometimes be obtained by looking into the larynx from above. Generally, the naked-eye evidences were those of epithelioma.

The patient survived thirteen months, and died of a recurrence which necessitated a second tracheotomy.

Thyrotomy, or division of the thyroid cartilages and removal of the diseased portion, leaving the cartilages intact, has been thought to be attended with immediate risk fully equal to that of unilateral excision, and to be withal too incomplete to take rank as a legitimate operation. Indeed, the unfavorable summary of its results by Bruns¹ caused this procedure for cancer to be almost abandoned in favor of laryngectomy. But a decided reaction has recently taken place. It is doubtful whether laryngectomy is ever successful in prolonging life for a longer period than a simple tracheotomy, or of giving immunity against recurrence (there are but two or three recorded instances in which patients have lived over two years), except in those cases in which intrinsic malignant disease, not extending to the pharynx, has been recognized before it has attacked the cartilaginous framework or invaded the glands. In such cases Butlin² has proposed and has successfully performed thyrotomy and erosion of all the soft tissues, including the growth of the affected side. This is probably the radical operation of the immediate future, and attempts at such will, it is hoped, be limited to this measure and to that class of cases for which it is indicated.

Sublingual pharyngotomy, which consists in division of the thyro-hyoid membrane and removal of the growth through the opening thus made, is applicable only to disease of the epiglottis, and is also a procedure of very limited and doubtful value.

3. *Hygienic and dietetic* treatment in the case of laryngeal cancer may be comprised in few words. Protection against impurities of the inspired atmosphere by respirators and residence in pure air, with the avoidance of tobacco and of ardent spirits, as well as of any habit or occupation likely to induce local irritation, are to be enjoined. So soon as there are symptoms of dysphagia, instead of efforts being made to force the deglutition of solids, immediate change of diet should be advised, and fluids and semi-solids, or at least artificially masticated and peptonized foods, should be prescribed. In some instances an occasional rest for a few days of the function of deglutition, and limitation of the act of swallowing to only sedative and thirst-allaying drinks, with administration of nutriment *per rectum*, are attended by improvement when attempts to swallow are resumed. Feeding by an œsophageal tube, except temporarily after operations, is a somewhat hazardous process, as perforation of the œsophagus may thereby be unintentionally induced. Swallowing of the raw egg *en bloc* is almost always possible, and the recommendation to suck small pieces of ice is a measure that is always gratefully acknowledged by the patient. Applications of cocaine prior to food-taking give relief in some cases, but this is a matter rather medical than hygienic in character.

¹ Die Laryngotomie zur Entfernung intralaryngealer Neubildungen, Berlin, 1878.

² Transactions of the Clinical Society, 1889.

TUBERCULOSIS AND SYPHILIS OF THE LARYNX.

BY J. SOLIS COHEN, A.M., M.D.,

Professor of Laryngology in Jefferson Medical College, etc., Philadelphia, Pa.

PART I.

TUBERCULOSIS OF THE LARYNX.

TUBERCULOSIS is one of the most frequent diseases of the larynx. It is usually fatal. It is often mistaken for catarrhal inflammation, for syphilis, and for carcinoma; less frequently it is mistaken for lupus and lepra. It is usually associated with pre-existing tuberculosis of the lungs, and, as a rule, with secondary tuberculosis in other organs, whether contiguous, as in the tongue, palate, and pharynx, and occasionally in the nose, or at a distance, as in the intestines, liver, spleen, kidneys, and testicles. In many cases it ushers in the final stages of a long-continued pulmonic or general tuberculosis which had theretofore spared the larynx. In a smaller number of cases it occurs in the course of glandular, arthritic, and ossific tuberculosis. Occasionally it is encountered as a presumptively primitive tuberculous lesion, and in rare instances the diagnosis of primitive tuberculosis has been verified post mortem by the absence of tuberculosis in any other organ.

PATHOLOGY.

Modern pathology attributes tuberculosis to the presence of special characteristic bacilli,—the tubercle-bacilli. In primary tuberculosis these bacilli must gain access from without, unless we accept the improbable hypothesis that tuberculosis, like syphilis, may long remain latent, to be aroused into activity by unfavorable circumstances. In the few instances of presumptive primitive tuberculosis in my own practice, the early manifestations had followed acute laryngitis from exposure to cold and damp air in every case but one. It may be inferred therefore, if we are to accept the prevalent opinion as to the bacillus, that an acute laryngitis with some desquamation of epithelium afforded the inlet for bacilli to the inspiration of which the patients happened to be exposed while the larynx was in this condition. It is not improbable that certain bacillary elements exist normally in the tissues of the healthy individual, which under certain

conditions undergo conversion into tubercle-bacilli, just as organisms normally found in the throat become converted into diphtheritic organisms under special conditions; or as other organisms in the nasal passages become converted into those of acute coryza in some instances and into those of acute pneumonia in others; and the like in other diseases.

Except in the rare instances just alluded to in which post-mortem evidences of tuberculosis elsewhere than in the larynx could not be detected, primary tuberculosis of the larynx is followed by undoubted tuberculosis of the lungs within a very few weeks. The earliest lesions I have noted laryngoscopically have been pallor and thickening of the epiglottis. This is soon followed by a shallow irregular ulceration upon the laryngeal face of the epiglottis (Fig. 1).

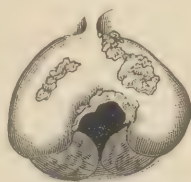
Multiple ulcerations of the same kind occur at different points and sometimes undergo coalescence, while similar processes occur upon the edge and lingual surface of the epiglottis (Fig. 2). The process continuing, ulcerative destruction of the epiglottis may take place (Fig. 3). Meanwhile, similar lesions take place at various portions of the larynx which

FIG. 1.



Thickened omega-like and ulcerated epiglottis.

FIG. 2.



Progressive ulceration of epiglottis.

FIG. 3.



Destructive ulceration of epiglottis.

may ultimately invade its entire superficies and extend down the trachea in the one direction and along the tongue, palato-lingual folds, tonsils, palate, uvula, gums, and even the lips and the cheek, in the other. In some instances the destructive process stops short at the vocal bands, which are not invaded, probably owing to the change there in the epithelial investiture.

Acute tuberculosis of the larynx occurs as part and parcel of acute tuberculous sore throat, first so admirably described by Isambert, and subsequently by Fraenkel and others. It is an acute miliary tuberculosis of the larynx, pharynx, and intra-oral structures, which undergoes ulceration very rapidly and terminates fatally within a few weeks as acute tuberculosis of the lungs and of other organs. I have had the good fortune of seeing two cases of this tuberculous sore throat, in which, at the time I was called, the infiltration was confined to the uvula, soft palate, and tonsils, and in which the presumptive diagnosis was promptly confirmed by microscopic inspection of fragments of invaded tissue removed for the purpose, just before treatment was instituted. This treatment consisted mainly in scraping the diseased tissues away until the sense of touch

conveyed to the curette was such as is indicative of healthy tissue only, and then in energetic frictions with concentrated lactic acid. The patients, one a quite young gentleman, and the other a physician over forty, recovered promptly, and have remained well ever since,—now a number of years. This success in these instances is demonstrative of a strictly local disease at the time that the energetic measures were instituted, the removal of which insured the patients from extension by contiguity or by absorption into the lymphous and sanguinous circulation.

Abundant disseminations of confluent patches of miliary tubercle become evident beneath the epithelium, which bleeds freely upon being touched. They usually appear first upon the palate, the anterior palatine folds, the tonsils, and the pharynx; and at a later stage upon the epiglottis and the larynx. They are exquisitely painful, so much so that swallowing may become impracticable. Ulceration soon takes place, and numbers of the tubercles undergo enucleation, so that empty sacs are formed, with losses of substance of varying depth; but death usually ensues from asthenia before the ravages can become very extensive.

Miliary tubercle has been observed on the larynx at a very early age. I have exhibited¹ a specimen from the larynx of an infant seven months of age, for the sections from which I was indebted to my friend Dr. Seiler.

Secondary tuberculosis of the larynx may begin in the mucous membrane by external attack from the virus deposited upon projecting structures in ejection of sputa from the lungs and lower air-passages. This opinion, long ago advanced by Louis and for many recent years discredited, has been revived since the recognition of the important part played in tuberculosis by the tubercle-bacillus.

In the majority of cases the infiltration takes place by the lymph-channels. In these cases no tubercle is found at first in the epithelium, for the infiltration is always beneath the epithelium, usually in the mucosa and the submucosa, and exceptionally as deeply as the layers of mucous glands. It may, indeed, be most dense in the very vicinity of the glands, infiltrating the interacinal connective tissue, and sometimes the glands themselves, so profusely as to render discrimination difficult between ordinary tubercular masses and infiltrated glands. The infiltration of the mucous membrane may be uniformly distributed through its entire thickness. In the majority of instances it is found in the uppermost portion of the mucosa only, just beneath the epithelium. Sometimes there is quite a free space (Heinze) between the epithelium and the most superficial tubercle. The overlying epithelium often appears normal, and remains well attached until the period of ulceration has commenced. Individual tubercles are often more abundant in the upper portions of the mucosa, and more sparse towards the deeper portion, where the granular infiltration will likewise be less. Older tubercles occupy the central portion of the mucous membrane

¹ American Journal of the Medical Sciences, January, 1883.

chiefly, and young ones the subepithelial portions. When the case is advanced, extensive caseation takes place both in the tubercles and in the tissue immediately contiguous, especially near the periphery. When the glands become implicated they undergo two processes of infiltration simultaneously,—interacinous, or infiltration between the acini, and intra-acinous, or infiltration within the acini. The interacinous infiltrations separate the individual acini and compress them partially. Early in the process, or at a later stage, as may be, miliary tubercles become grouped both in the connective tissue between the individual glands and in that between the individual acini of individual glands. The gland cells lining the membrane proper become detached and undergo destruction; and as the membrane is forced inward by the pressure exerted upon it externally, the diameters of the acini show that the acini have undergone change by compression from globular into irregular ovoid and elliptic bodies. Many acini finally undergo destruction, partial or complete, from fatty degeneration in sequence to the combined pressure from within and from without. The ducts (Heinze) resist the process longer than the acini.

The ulceration may be due to a simple melting away, as it were, of the unorganizable product without any purulent process whatever. Such ulceration, too, may be at times covered with purulent products coughed up from the air-passages. In other instances there is a more or less abundant purulent process associated with the destructive metamorphoses of the tuberculous infiltration. It is to this purulent process that much of the œdema and perichondritis occurring in some cases of tuberculosis of the larynx is attributed.

The repeated and almost continuous exposures of the eroded or ulcerated mucous membrane to fresh involutions from adherent pulmonic sputa often prevent the completion of reparative processes that may have begun, and this may recur again and again.

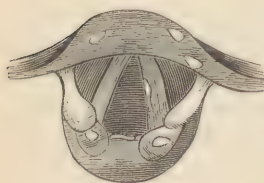
Secondary infiltration of tubercle in the larynx takes place, as a rule, only in subjects of pulmonary tuberculosis, and more frequently in hereditary tuberculosis than in original cases. It occurs both in an acuter and in a more chronic form. The acuter form occurs chiefly in cases of rapidly-caseating pulmonary tuberculosis, and pursues its course to a fatal termination in from six to eighteen months. The more chronic form, which presents in several varieties, occurs chiefly at a comparatively advanced stage of the more languid cases of tuberculosis which have commenced as a localized pneumonitis. These cases last from two to four years, and even longer.

Congestion of the mucous membrane almost always marks the earliest recognizable stage of the acuter form, while pallor of the mucous membrane almost always characterizes the earliest recognizable stage of the chronic and more frequent form.

The acuter form usually begins only after softening has taken place in the pulmonary lesions. The intense initial catarrhal laryngitis subsides in

from two to three weeks into a severe chronic laryngitis without characteristic features; but characteristic features begin to become superimposed in the course of from three to six weeks later. These consist, first, in isolated and soon multiple shallow erosions upon the laryngeal surface of the epiglottis and upon other portions of the laryngeal mucous membrane; and second, in localized tumefactions, most frequent in the epiglottis and in the arytenoidal extremities of the ary-epiglottic folds. These superficial ulcerations (Fig. 4), which may or may not be associated with other local

FIG. 4.



Initial multiple superficial ulcerations of the acuter forms of secondary tuberculosis.

manifestations of tuberculosis, present at first the closest similitude to the catarrhal epithelial erosions or aphthous ulcerations of any form of chronic laryngitis with especially irritating secretory products, and are to be distinguished as tuberculous in origin chiefly by their multiple character. On the epiglottis, where they are most frequent, and on the pharyngeal surface of the supra-arytenoid cartilages, they are usually roundish or oval in outline, while they are generally elliptic or fissure-like on the vocal bands and on the inter-arytenoid

folds. This difference in configuration is not marked in mere catarrhal erosions. These superficial ulcerations gradually extend in depth and in periphery and often undergo coalescence, while fresh superficial ulceration may take place simultaneously in other localities. When subjected to microscopic inspection, these later superficial ulcerations are in some instances found to be confined to the epithelial layer, and in others to extend to the subepithelial layers of the mucosa; while contiguous portions of unexfoliated epithelium are seen to be turbid, and, at points, partially detached. Ulcerations more deeply penetrating the mucosa exhibit different stages of cell infiltration, erosion of vessels, and accumulations of detritus and of fatty degeneration; but no miliary tubercle can be detected either in the beds and edges of the ulcers or in the tissues in their immediate vicinage. It is therefore doubtful that they are the immediate product of miliary tubercle, unless it be conceded that the tubercle is rapidly subject to destruction and discharge.

Later in the disease, however, when these ulcerations have extended in depth and in periphery and by coalescence, their positive tuberculous character becomes manifest by the detection of secondary miliary tuberculosis in the tissues immediately contiguous. Should the patient die in this stage, evidence of more or less miliary tubercle may be found isolated or more or less equally distributed in the mucous membrane of the larynx or of the larynx and trachea. Sometimes this stops short at the vocal bands. Sometimes the vocal bands are free from tubercle, and tubercle is abundant in the subglottic portion of the larynx, ceasing abruptly again at the region of the crico-thyroid membrane or the cricoid cartilage.

Not many days after the advent of the shallow ulcerations described,

and while they are increasing in depth, in periphery, and by coalescence, certain characteristic circumscribed tumefactions begin. They may even precede this early ulcerative process, and they may occur at any stage of the disease. Sometimes they remain the sole visible manifestations of tuberculosis. These circumscribed tumefactions take place chiefly in the mucous membrane of the epiglottis, ventricular bands, and vocal bands; less frequently in the inter-arytenoid fold, and least frequently in the ary-epiglottic folds; presenting in the latter respect a marked contrast to the more chronic form of the disease, in which these folds present characteristic intumescent infiltration much more frequently than any other structures. The epiglottis becomes thickened on its posterior aspect to several times its normal dimensions, thus impeding its function as an obturator to the larynx in swallowing. The ventricular bands may thicken so as to overlap the vocal bands and even cut their very edges off from laryngoscopic view entirely. The vocal bands may become so thickened as to justify their being termed vocal cords. Their inferior surface becomes very much thickened, sometimes to such an extent as largely to exceed the bulk of the ventricular bands. Thus they may produce occlusion of the larynx and threaten suffocation. The surface of the mucous membrane becomes irregularly tumid, pale-grayish in tint, looks sodden and corrugated, and often supports a dingy yellow pultaceous mass of detritus.

Microscopic inspection of these tumefactions at an advanced date usually reveals copious infiltration of small lymphoid cells in mucosa and sub-mucosa, quite down to the glandular layer, and massed here and there into tubercle nodules or groups of miliary tubercle, some of which are undergoing caseation. The older tubercles are the more deeply situated.

While the glands are not often infiltrated, infiltration is usually massed around them and between their individual acini, which are compressed out of their normal shape, and become subjected to fatty degeneration from pressure.

When the epithelium becomes detached over these tumefactions, hemorrhagic tuberculous ulcers are exposed, which are liable to extend rapidly in very irregular outlines. Their edges are well defined and often injected or slightly hemorrhagic. Their beds are uneven or irregularly mamillated, and are usually covered with caseous detritus. The ulcerations deepen and deepen in converging outlines, or they undermine the contiguous structures at various points of their periphery. They extend to the utmost limits of the cell-infiltration, and may thus lay bare the perichondrium, which is the first structure met that seems able to resist direct tuberculization.

Under microscopic inspection these ulcerations usually show one of three conditions: 1, no evidence of tubercle on either the bed or the edges of the ulcer, but infiltrations of granular tubercle in immediate contiguity or at a short distance; or, 2, infiltration either of granular tubercle or of nodular tubercle in edges or bed or both, without either contiguous or more

distant infiltration; or, 3, and most frequently, tubercle in the edges and bed of the ulcer, associated with infiltration or granular tubercle, whether contiguous only or copiously disseminated throughout the mucous membrane. These ulcerations are liable, if time serves, to extend so as to involve the entire interior of the larynx, and even to mount and surround the exterior. All sharp outlines undergo effacement into thick irregular welts; and the whole structure may thus become transformed into an irregular, excoriated, ulcerating, almost fungoid mass. This is especially marked in the epiglottis and in the vocal bands; and the vocal band may become converted into a superimposed series of bands by fissural longitudinal ulceration.

Local suppurative centres of inflammation become established near these ulcerative processes in many cases, and as they reach the perichondrium that structure succumbs too, exposing the cartilage. The cartilage suffers in its turn, undergoes necrosis and caries, and becomes destroyed in detritus, as is most usual with the epiglottis, or in fragments and in mass, as with the vocal processes, arytenoid and supra-arytenoid cartilages, and even the cricoid, or in large plates, as with the cricoid and thyroid cartilages. These fragments are often expelled by expectoration; the posterior vocal processes and even the entire arytenoid cartilages being sometimes exfoliated in mass. Fragments of cartilage or detached cartilage are often seen loose, after death, in the abscess which surrounds them. The epiglottis is sometimes destroyed in its entire free portion, so that a mere irregular stump is left; and occasionally it is destroyed by progressive ulceration from the side.

The analogy presented between the laryngoscopic pictures and the microscopic features of this variety of tuberculosis and those of presumptive primary laryngeal tuberculosis strongly suggest the latter as probably more intensely acute examples of the former. Both occur in cases of rapid pulmonary tuberculosis; both progress uninterruptedly; both become associated with secondary tuberculosis of the trachea, pharynx, tongue, gums, lips, and cheeks.

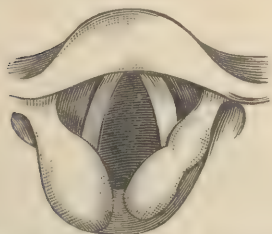
The more chronic form of secondary tuberculosis of the larynx rarely presents any distinct history of origin in exposure to cold or wet. It is rather insidious in its onset, but it is characterized by marked pallor or local anæmia of the mucous membrane of the larynx, sometimes associated with similar pallor in the pharynx and mouth, but wholly independent of general pallor which may at a later date be noted as an indication of general anæmia. This peculiar pallor is sometimes present in pulmonary tuberculosis as yet wholly unassociated with laryngeal tuberculosis. In many cases of laryngeal tuberculosis the pallor is followed by congestion as a result of the irritative disturbance produced by the tuberculous process, but in very many cases the pallid hue continues to the very last. Often there is general tumidity of the mucous membrane.

Irregular vascularity is often to be noted upon the mucous membrane; and at localities such as the inter-arytenoid folds and the ventricular bands,

where the mucous membrane is loosely attached to the submucosa structures, it becomes folded into irregular, wrinkled ridges or welts, red or gray in color and often distinctly villous. Ecchymoses and irregular varices are often to be seen on the laryngeal face of the epiglottis and upon other intra-laryngeal surfaces.

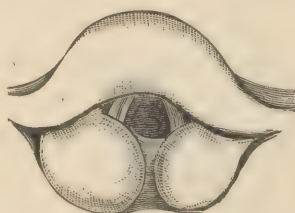
The localized tumefactions are most frequent in the tissue enclosing the apices of the supra-arytenoid cartilages, which undergo transformation into tumid club-shaped and finally distinctly pyriform or irregularly globose masses which taper towards their epiglottic extremity. When complete, all line of demarcation will have been obliterated between the cartilages of Wrisberg and of Santorini and the intervening tissue (Figs. 5 and 6).

FIG. 5.



Supra-arytenoid intumescence, beginning on the left side and complete on the right.

FIG. 6.



A later stage of supra-arytenoid intumescence, with thickenings in the epiglottis and on the vocal bands.

This process, beginning unilaterally, becomes bilateral in the great majority of instances.

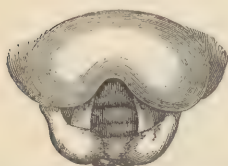
Although usually pale, these pyriform tumefactions may become greatly congested, occasionally to actual lividness at the points which are pressed together during speech or swallowing. This intumescence if unilateral, or the greater one of the two if bilateral, is almost always located on that side of the body in which the pulmonary disease is the more advanced. It may be regarded as sufficiently characteristic of coexisting pulmonary disease to be diagnostic. It occurs chiefly in slow cases commencing in localized pneumonitis, and is noticeable at a comparatively advanced period of the initial stage of the disease. It is a hyperplasia due to extensive proliferation of lymphoid cells in the adenoid tissue normally abundant (Wagner) in this location. The thickness of mucous membrane is often increased three- or fourfold, so that it may measure fully one centimetre. These tumefactions, in which both nodular and granular tubercle may be found later in the disease, never subside except in such partial measure as may be attributed to coexistent effusion of serum or other product resultant from the inflammatory process set up mechanically by pressure, by compression of vessels, or by irritation. They are distinct from the slight serous oedema sometimes noted in protracted subacute laryngitis.

In many cases tuberculous infiltration and the accompanying tumefaction convert the free thin edge of the epiglottis into a tumid somewhat

kidney-shaped welt so much resembling in outline the roll of a turban (Fig. 7) as to have suggested the term "turban-like epiglottis." As the infiltration increases, the lateral posteriors become bent towards each other, so that the epiglottis becomes a crescentic pad (Fig. 8) or cushion, which may so overhang the larynx as to conceal from view everything except the posterior portions of the pyramidal intumescence over the supra-arytenoid cartilages. The condition may, however, occur without association with pyriform swelling of the posterior arytenoidal structures. In these cases ulceration usually begins upon the laryngeal face and progressive destruction leaves but an irregular stump of epiglottis. This process is sometimes lateral, but much more frequently from above downward (Fig. 9).

In another group of cases the manifestations begin posteriorly, the epiglottis remaining normal permanently or for a long time, and being flaccid

FIG. 7.



Turban-like epiglottis of tuberculosis.

FIG. 8.



Crescentically swollen epiglottis overhanging the orifice of the larynx.

FIG. 9.



Tuberculous infiltration of larynx, showing lateral destruction of epiglottis from the side.

rather than rigid. The most frequent point of attack is the inner surface of the meso-arytenoid fold, which eventually becomes implicated, also, in most other cases, what-

ever may have been the earlier manifestations. The mucous membrane becomes red and corrugated, sometimes irregularly tumid in projections which often become so bulky as to resemble polypoid excrecences, in some instances condylomatous (Fig. 10), in others acuminated (Fig. 11).

Microscopic examination of sections from such tissues discloses nodular

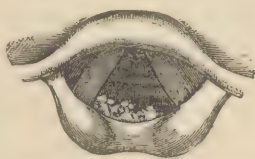
and granular tubercle beneath the epithelium. Before long superficial ulcerations take place, which increase in periphery and by coalescence. They become covered with yellowish-grayish detritus, beneath which the surface is seen to be irregular and slightly hemorrhagic whenever the detritus is removed with brush or sponge, douche or spray, and sometimes when removed by expectoration. The surface is almost continuously covered with a thin layer of various products of secretion and disintegration. The ulcerative process sometimes extends deeply down the larynx, often far beyond the utmost limits of ordinary laryngoscopic inspection. In all these varieties of examples of secondary tuberculosis thus far mentioned the normal tint of the vocal bands is in many cases preserved for a long time. In others they are injected, sometimes deeply congested, and occasionally hemorrhagic over some portion of their surface. But the peculiar polish of the healthy band is lost in almost every instance and replaced by a dull or dingy aspect. In other cases, although the general surface of the vocal bands is congested, opalescent patches remain, dingy white, and more or less irregularly parallelogrammic in outline,—probably groups of turbid squamous epithelia. In some cases the smoothness of surface is interrupted by projections resembling granulations in excess. When ulceration takes

FIG. 10.



Condylomatous meso-arytenoid infiltration; color normal; softening at right apex.

FIG. 11.



Acuminated meso-arytenoid infiltration; red right vocal band; condensation at right apex.

FIG. 12.



Ulcerated vocal bands and left ventricular band; solidification at right apex; cavity in left apex.

place it usually begins posteriorly in the edges of the vocal bands, which become irregular in outline (Fig. 12), sometimes by solid losses of substance as though removed with a punch, sometimes in irregular serrations. Sometimes a vocal band becomes destroyed in a transverse section, and then the retraction takes place in the fragments, giving the glottis a very irregular outline. When it gives way at the posterior vocal process, that structure will project crosswise in the glottic space. Fungous vegetations are sometimes developed upon the ulcerated edges of the vocal bands, and then adhesions may take place anteriorly between the two bands.

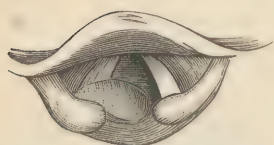
There is still a series of cases in which the principal manifestations are in the vocal bands only. Their posterior surfaces become so intumescent as to project beyond the edge of the bands and even to encroach seriously upon the calibre of the larynx; so much so in occasional instances as to threaten suffocation and require the operation of tracheotomy. Ulceration in these cases is usually longitudinal, and it may split the band into irregular masses resembling neoplastic formations.

Perichondritis and chondritis occur in the later stages of prolonged cases. They are most frequently inflammatory processes of septic origin due to the tuberculosis, but not a direct result of the tuberculous process itself. Tubercle is rarely found near the perichondrium. After ulceration has taken place, access of bacilli becomes easy.

The perichondritis and chondritis may be confined to one surface of the cartilage or to a limited extent of it, or they may involve both surfaces and lead to great destruction of structure. But they are not always in proportionate activity with the intensity of the tuberculous process by which they are occasioned.

Abscess is a not infrequent result of perichondritis. It usually points inward towards the free surface of the larynx

FIG. 13.



Abscess over right side of internal face of cricoid cartilage.

inward towards the free surface of the larynx (Fig. 13), upon which it may so encroach as to threaten suffocation. After the abscess has been discharged, whether spontaneously or by surgical procedure, fragments of necrosed cartilage are to be seen in some cases projecting into the cavity of the larynx. This is most frequent with the posterior vocal process and the arytenoid and supra-arytenoid cartilages, and much less frequent with the cricoid cartilage.

Apart from the polypoid excrescences in the meso-arytenoid fold and the fungous vegetations which project from the beds of ulcerating tissues, a special tuberculous tumor becomes developed in some cases before any other laryngeal lesion and often long before any pulmonary lesion can be detected. While such growths have been noted from time to time in association with tuberculous laryngitis, it is only of late years that their tuberculous character has been determined by microscopic investigations.¹

Dr. Gouguenheim, of Paris, has made a special study of these neoplasms, which is summed up in the recent treatise on laryngeal phthisis² written by Tissier and himself. They vary from the bulk of pin-heads to that of cherries. They are usually smooth and solitary; but according to Gouguenheim they are much more frequently multiple and lobulated, and so readily removable that they are sometimes expectorated in coughing, though they may be firm and attain such size as to threaten suffocation. They recur readily when removed. This accords more with excessive granulation growth than with actual tumor. The peculiar feature of the tuberculous tumors is said to be the utter absence of ulceration in or around them until after a late stage of their development, when they undergo the destructive process common to tuberculous products.

¹ Especially by John N. Mackenzie, *Maryland Medical Journal*, June 1, 1882; Schnitzler, *Wiener Medicinische Presse*, April, 1883; Kidd, *Medical Times*, August 28, 1884, and others.

² *Phthisie Laryngée*, Paris, 1889.

ETIOLOGY.

A predisposition to catarrhal inflammations of the mucous membrane of the aerial tract may be regarded as the chief cause of tuberculosis of the larynx. Inherited delicacy is more pronounced than acquired delicacy. In primitive tuberculous laryngitis a severe catarrhal process with exfoliation of epithelium is the direct predisposing cause, and exposure in some way or other to the tubercle-bacillus the exciting cause.

In secondary tuberculosis the pre-existent tuberculosis of the lungs is the predisposing cause, and detention of bacillary sputa in the lungs, or transference of bacilli through the blood- and lymph-channels, the direct exciting cause.

No age is exempt, but the period between twenty and thirty years is the most prolific. Men are more liable than women. An illustration is given in this article from tuberculous laryngitis at seven months of age, and a number of cases have been reported by others in patients less than five years of age. It is infrequent, again, in advanced life. Exposure to inclement weather is a prominent factor in the production of tuberculosis of the larynx.

SYMPTOMATOLOGY.

The objective symptoms as detected laryngoscopically are the anæmias, congestions, tumefactions, erosions, ulcerations, and consequent changes which have been described under Pathology, and which need no re-enumeration here.

The subjective symptoms are sensations as from foreign bodies, dysphonia, cough, dyspnoea, dysphagia, and pain. While none of these symptoms are characteristically indicative of the onset of tuberculous laryngitis, some of them when pronounced, and especially in characteristically cachectic subjects, are sufficiently pathognomonic of advanced tuberculosis. The earliest of these symptoms is usually dysphonia. The impairment of voice varies with the character and location of the lesion: sometimes nervous and presumptively due to malnutrition, as evinced by the pallor of the larynx; sometimes mechanical and due to pressure upon nerve-tracts of enlarged laryngeal, tracheal, or bronchial glands, or to more evident causes which are revealed upon laryngoscopic inspection, as productive of impediment to the close approximation, tension, or vibration of the vocal bands. This dysphonia varies with the condition of the parts, and it may improve or get worse again and again without at all affecting the course of the disease. It often progresses to complete aphonia, which may be due to thickenings of the vocal bands or of the ventricular bands or of the aryteno-epiglottic folds posteriorly; to interposition of morbid growths between the vocal bands; to ulceration of the bands; or to ulcerative processes posteriorly, keeping the bands asunder. When these conditions subside the voice will be improved, although the patient may really be much worse.

Dysphagia due to mechanical impediment in deglutition attends cases of

thickening and stiffening of the epiglottis, and pyriform tumefactions of the arytenoidal tissues, but it is not painful even when ulceration has largely destroyed the epiglottis. Deglutition is not painful even though food may go the wrong way and enter the larynx, whence it must be expelled by cough. But when the ulceration occupies the posterior wall of the larynx, especially at the upper rim and still more so when it occupies the posterior surface of the posterior wall, the odynphagia or pain in swallowing may become intense. Some patients will refuse to swallow for hours, rather than purchase respite from hunger at the cost of the pain in the effort. The pain in swallowing saliva, water, and especially beef-tea, is far greater than that produced in deglutition of solids and semi-solids. When the ulceration occupies the region of the pharyngo-epiglottic fold, the pain stretches up into the ears.

Pain in the larynx is not prominent as a continuous symptom except in ulceration of the lateral edge of the epiglottis low down where it merges into the pharyngo-epiglottic fold. Pain is not severe upon either external or internal manipulation of the larynx except when the posterior wall is prominently involved, when motion laterally will be often quite painful. Internal manipulation provokes paroxysmal cough. In some cases there is severe pain, less apparently from the amount of ulcerative action going on than from exposure of nerve-filaments. When the epiglottis is ulcerated, pain running to the ears is often complained of, and is sometimes much more severe than that in the epiglottis itself, which is sometimes not at all painful, or even sensitive to the contact of the finger or instruments.

Dyspnœa does not ensue in consequence of the laryngeal lesions until they are comparatively advanced. When the motions of the arytenoid cartilage are impeded by infiltration about its articulation with the cricoid, when from other causes the vocal bands cannot be maintained sufficiently removed from the middle line, when tumefactions of various structures occlude the aerial tract of the larynx, or when tumors and vegetations or loose fragments of detached tissues obstruct it, then there will be more or less dyspnœa. This may augment almost to actual apnœa, and even necessitate tracheotomy or some other surgical procedure to avoid suffocation.

Cough is present in almost all cases of laryngeal tuberculosis, but I have seen cases without cough except when necessary to expel sputa from points below the larynx. The cough is at first dry, hacking and laryngeal, and due often to unpleasant sensations in the larynx described as ticklings, scratchings, or other manifestations of discomfort. It is not painful, except in very advanced stages of ulceration at points which are especially disturbed in the acts of cough and expectoration. Expectoration is not excessive except when the lungs are largely involved, and then masses of sputa are sometimes detained awhile in the larynx, whence they are detached by spontaneous or provoked laryngeal cough. Finally, the presence of the ordinary symptoms of pulmonary tuberculosis leads to the inference that an attendant laryngitis is probably of tuberculous origin.

Involvement of the trachea is sometimes devoid of symptoms, especially when the larynx is but slightly involved. Perforation of the membranous portion of the trachea sometimes occurs, and then there may be violent cough after swallowing, from escape of food from the œsophagus into the trachea.

DIAGNOSIS.

The diagnosis of primitive tuberculosis will rest mainly on the absolute absence of any positive evidence of tuberculosis in the lungs and in remote organs, while its manifestations are indubitable in the larynx, or additionally in the pharynx, uvula, palate, and tongue subsequently to the manifestation in the larynx. The acute pain attending swallowing is strongly suggestive of acute tuberculosis, in which that symptom is far more intense than in secondary tuberculosis. The objective indications in the uvula especially are quite characteristic when that structure is involved. The uvula becomes transformed into a semi-translucent club-shaped structure (Fig. 14) entirely different in aspect from that resulting from ordinary œdema.

FIG. 14.



Club-shaped uvula in primary tuberculosis of the larynx. Palate involved.

Miliary tubercle is sometimes recognizable laryngoscopically, but its aspect is so similar to that produced by simple hypertrophy of racemose glands (Fig. 15) that it cannot be relied upon as a diagnostic feature unless occurring in localities devoid of glands, or unless associated with other unmistakable evidences of tuberculosis when occurring in regions supplied with glands.

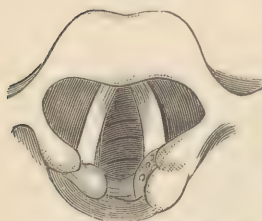
Many cases of chronic tuberculosis begin in subacute catarrh of the mucous membrane. In its early stages this catarrh cannot be distinguished as peculiarly precursory to tuberculosis by any manifestations presented either by subjective symptom or by laryngoscopic inspection. Delicacy of constitution, great impairment in general vigor, positive evidence of hereditary tendency to pulmonary disease, are to be relied on as indicative of the serious nature of the catarrh. Resistance to the influence of legitimate therapeutic procedures, and the gradual subsidence of the catarrh into a chronic phase, are strongly suggestive of its dependence on constitutionally degenerative processes. Coexisting indications of pneumonic degeneration, even when amounting to nothing more than impaired respiratory movement, point strongly to the tuberculous character of the chronic laryngitis.

The diagnosis will rest chiefly on the laryngoscopic evidences of the diseased conditions described under Pathology: the peculiar pallor; the pyriform tumefactions of the posterior portions of the aryteno-epiglottic fold; the circumscribed tumefactions in the meso-arytenoid fold and else-

where; the turban-like or horseshoe epiglottis; the multiple erosions, ulcerations, etc.

There may be no abnormal appearance of the supra-arytenoid and aryteno-epiglottic structures, in some cases not even pallor, and yet extensive exulceration may exist along the entire posterior intra-laryngeal wall, reaching from the base of one supra-arytenoid cartilage to the other, and down far beyond the extreme limits of laryngoscopic inspection.

FIG. 15.



Hypertrophic glands simulating tubercle.

A great step forward in detecting the ravages made by tuberculosis in the posterior wall of the larynx has been made by Dr. Killian,¹ and has been still further developed by his pupil Dr. Rudolf Keller, Assistant Surgeon in the Poliklinik

of the University of Freiburg.² Holding the mirror horizontally and looking upon it from below has been practised since the time of Türk, by whom it was well described, but to Killian is due the demonstration that forcible bending of the patient's head forward, and gazing upon the horizontalized or slightly obliquely backward reflecting surface, exposes in many instances the entire posterior wall of the larynx and of the uppermost portion of the trachea. The patient stands, and the physician kneels before him. If the distance from the eye of the observer to the posterior wall of the patient's larynx is very great, a reflector of twenty-five centimetres' focus may be requisite instead of the customary one of twenty centimetres' focus. The image of the posterior wall of the larynx is seen presenting obliquely upward from the inter-arytenoid incisure to the lower border of the plate of the cricoid cartilage; the epiglottis in front and the posterior wall behind, and not reversed as in the ordinary laryngoscopic procedure.

PROGNOSIS.

The prognosis is always grave. Very few cases recover. A case mentioned in my treatise on Diseases of the Throat and Nasal Passages (1879) as having lived more than eight years after I had removed the tuberculous epiglottis is still alive and in comparatively good health, now a period of twenty-two years. Several other patients have recovered so far as to have resumed their vocations and to have enjoyed their lives for many years. Still, when I sum up the entire number of my patients with tuberculosis, these absolute recoveries do not represent one per centum of the entire number. Nevertheless, the very fact of occasional recovery under treatment is encouraging; and the proportionate success will increase as the indications of favorable prognosis are more accurately ascertained and appropriate treatment more accurately instituted.

¹ Tageblatt der Heidelberger Naturforscher Versammlung, 1889, p. 577.

² Münchener Medicinische Wochenschrift, Juni 7, 14, 1892, illustrated.

In collating the cases which have occurred in my own practice, I am appreciating the fact that there are certain objective indications which, studied out and compared with future observations to the same purport, will aid us in estimating the length of days remaining at the disposal of the sufferer, and in prolonging the remnant of his existence by judicious therapeutic measures.

Acute tuberculosis of the larynx is almost certain to terminate fatally at a period varying from six weeks to six months. Some cases terminate still more rapidly, others linger a few weeks or months longer. Recovery is so rare that the accuracy of diagnosis may be fairly questioned in the few instances on record; especially in the face of the fact that the aspect of the disease and its immediate ravages bear very close physical similitude to the progress of acute latent and tertiary syphilis. So close is this resemblance in many instances that the test of anti-syphilitic medication must be applied before a positive opinion can be pronounced as to the tuberculous or syphilitic character of the case.

Previous to the discrimination of acute tuberculosis of the larynx these cases were regarded as syphilitic, and the failures to cure it were attributed to the profound dyscrasia under which the patient labored.

The shortest variety of chronic tuberculosis becomes engrafted, so to speak, upon that variety of pulmonary tuberculosis characterized by rapid caseation of the pneumonitic foci. It occurs early in the malady, coincidentally, perhaps, with the giving way of the pulmonary tissue, and runs its course to a fatal termination in from six to eighteen months.

The differential indication of this form of tuberculosis, in which the tenure of life may be estimated at from six to eighteen months, according to the activity of the process and the existing complication, is to be recognized by the initial multiple minute ulcerations upon the epiglottis, particularly in the early stages, and the subsequent tumefactions at the anterior portion of the larynx, followed by progressive extensive ulcerations, tuberculous and suppurative. Ulceration limited to the epiglottis indicates much more rapid progress to the fatal issue. Impairment of voice, dyspnoea, and later in the case dysphagia and pain in swallowing, are the most characteristic subjective local symptoms.

The more chronic varieties of laryngeal tuberculosis occur in the more torpid cases of pulmonary tuberculosis beginning in localized pneumonias. The larynx does not become involved until the disease has considerably advanced in the lung, and softening is imminent or is already in progress. These cases last from two to four years on the average, and sometimes much longer.

Pallor of the mucous membrane is perhaps the earliest marked characteristic. The participation of the larynx is passive, so to speak, rather than active, and the tuberculous process is much slower in its manifestation and its progress.

Little by little the component structures of the borders and anterior of

the larynx lose their marked outlines and become more and more tumid, while circumscribed tumefactions of much more marked character take place at different points liberally supplied with normal lymphoid cells. These cases are slow in progress, as a rule, unless the patient be the subject of marked cachexia, when the destructive process may ensue as rapidly as in the slower cases of the subacute variety. The tumefactions may remain the only visible objective indications during the entire malady, but in advanced stages ulcerations are liable to ensue as in the other varieties, and not only at the points mentioned, but in other parts of the structures.

The tardy progress of the morbid process affords better opportunity for beneficial results from therapeutic measures; and their judicious selection at an early period in the disease may not only prolong the life of the patient, but even start him on the road to recovery.

The condition of the voice, upon which great stress is placed by the patient and his friends, cannot be taken as indicative of the prognosis unless improvement can be noted laryngoscopically, for changes in the condition of the part may favor approximation, tension, or vibration of the vocal bands even in the midst of a destructive process indicative of some progress from bad to worse. On the other hand, temporary extinction of voice may go hand in hand with a restorative process of happy augury.

Tuberculous ulcers rarely heal. Exceptional cases occur in which cicatrization takes place, occasionally spontaneously, more frequently under active topical procedures when amenable to endo-laryngeal manipulation. Although healthy granulations may become formed on the floor of the ulcer, in most instances fresh tuberculous infiltration takes place in the newly-formed tissue, which speedily succumbs. Exuberant granulations are often developed in these ulcers, which even proliferate at times into veritable tumors or vegetations which sometimes require operative measures to avert disastrous obstruction to the respiration. When pulmonary tuberculosis follows in sequence to caseous pneumonitis, the general vitality of the tissues becomes so impaired that even follicular ulcerations of the larynx are insusceptible of cure. The proportionate number of patients with pulmonary tuberculosis who suffer with tuberculosis of the larynx, though greater in hospital than in private practice, has not been as large in my experience as in that of most other writers on the subject. It has ranged probably somewhere between five and ten per centum. From twenty to forty per centum is reported by others. The character of the practice has much to do with this discrepancy. Men are far more liable than women, probably in the proportion of three to one; and this preponderance may be attributed to their more frequent exposure to inclement weather, and often to the necessity of continuing work for their subsistence almost to the latest moment possible.

TREATMENT.

Both the constitutional malady and the local lesions require treatment. The constitutional treatment will vary but slightly from that suitable for pulmonary tuberculosis without laryngeal complication. This will include measures instituted to provide in the best manner for maintaining super-nutrition on the one hand, and for preserving the respiratory functions in the best manner. When at all practicable, and as far as practicable save when contra-indicated by high temperature and other conditions, as much animal diet should be consumed as the digestive organs can dispose of. Efforts should be made to make the patient pass several hours of the twenty-four in the open air whenever the weather permits. This exposure to the open air need not always be continuous; but, in accordance with the strength of the patient and his surroundings, it may be taken at intervals which added together comprise the length of exposure required.

When the body temperature exceeds 100° the patient should be kept at rest in the recumbent position. Should the body temperature reach 102° it is the custom of the writer to have ice-bags kept continuously over the chest until the temperature shows a steady decline to 100° or less. Sometimes these bags are maintained until the temperature has become normal and has remained so for forty-eight hours. In many cases these applications have been kept continuously applied for many days, and in exceptional cases for as long as six weeks. It is very rarely indeed that they have been found injurious, and then of course they must be suspended. They often relieve cough as well as reduce temperature.

Of all medicinal agents employed constitutionally no one of late years has been as beneficial to my patients as creosote, which must not be given without caution to patients subject to pulmonary hemorrhages, or under very high temperatures. The creosote should be suspended until the temperature sinks, or until the hemorrhage has been followed by quiescence therefrom for a fortnight or so, as may be. It may be given in doses varying from half a minim to ten minims, or even more, three or four times a day. One of my patients, a physician, pushed his dose to one hundred and eighty minims in the twenty-four hours before he came under my care, but acknowledged that while he stood the dose very well he could not assert that he did any better—and he did well—under large doses than he did under doses of from ten to fifteen minims. Creosote may be given before meals, after meals, or between meals, as it best agrees. It may be given in capsules alone, or combined with wine or tonic tinctures, or with milk. My experience has confirmed that of my friend Dr. Glasgow, of St. Louis, that it is best borne in milk in most instances. A tablespoonful or more of milk is poured into a sterilized bottle; the creosote is then added and well agitated, and the dose poured into a wineglass for administration. When the dose can be borne before meals, that is the best time for its administration. The stomach is subjected to the disinfection process

before food is taken into it, and the partial protection from decomposition of the food is greater. It is by disinfecting the digestive tract in the first instance and thus restraining decomposition that nutrition is improved; and it is by elimination of the drug in part through the respiratory tract in the second place, that that tract is also subjected to disinfection, and that the undiseased tissues are thus afforded a partial protection from invasion by infection from contact. I have not had any experience in the hypodermatic injection of creosote, nor am I personally cognizant of a case in which this method has been pursued.

I have seen such bad effects from hypodermatic injections of tuberculin, forcing the disease from bad to worse, that I have refrained from its use. Two cases now under my care in the Home for Consumptives have been receiving injections of tuberculocidin begun by my colleague Dr. F. P. Henry according to the method counselled by Klebs, and are doing remarkably well; but, inasmuch as other patients in the same institution are doing equally well without these injections, it is at present impossible to justly estimate their beneficial influence. That they have not been injurious, however, has been fully evident, and one patient is so much improved as to have undertaken supernumerary service as a nurse in the institution.

Systematic muscular movements should be made at regular intervals,—say night and morning at the toilet. They favor circulation of the blood and of the lymph, and they keep the areolar tissue in better extension and elasticity. Occasional movements at irregular intervals are likewise beneficial, as also is systematic massage.

Treatment of the local lesions varies with the character of the lesions, their position, their extent, their influence upon deglutition and respiration, and their accessibility to topical measures. Such treatment often becomes absolutely necessary to afford relief, temporary as that relief may be, and it is often competent to afford continuous relief for several days in succession. Circumscribed thickenings with unbroken surface are subjected in my hands to topical applications daily or less frequently with a sponge saturated in a creosoted solution of iodine,—usually creosote, minims v, iodine, grains v, potassium iodide, grains xx, to the fluidounce of glycerin. Topical applications of a creosoted solution of menthol in vaseline oil or in olive oil, twelve minims of creosote and sixty grains of menthol to the ounce, are often beneficial. Sometimes the combination of these two solutions does better than either of them alone.

When ulceration has taken place, I have found nothing to equal insufflations with iodoform, if the powder will stick to the parts. If it will not stick it can be dissolved, just before using it, in sulphuric ether from one part to fifteen parts to one to three, or in chloroform. When this is applied the ether or the chloroform evaporates, leaving a layer of iodoform on the parts. Iodol, aristol, dermatol, and eucophen do not replace the iodoform therapeutically, but must be substituted for it in cases in which the odor from iodoform cannot be tolerated. Any secretion present should be re-

moved by the direct propulsion of alkaline sprays, sodium bicarbonate or sodium borate two or three grains to the ounce of warm water, or of tar-water, before the topical applications are made, otherwise the secretions will be medicated rather than the diseased tissues.

Treatment of ulcerations by cauterization is, as a rule, pernicious, unless practised upon the principle of absolutely destroying tuberculous tissues so as to favor cicatrization by granulation in healthy tissue. This treatment, the lines of which were first clearly mapped out by Krause, of Berlin, is particularly appropriate when the lesions are accessible. Applied to regions out of reach or to lesions extending beyond reach, it fails to fulfil the proper indications and may be injurious. Starting on the principles laid down in attacking lupus with lactic acid, which destroyed the diseased tissue but spared the healthy, Krause introduced the topical use of lactic acid in tuberculosis of the larynx and other accessible regions; and there is no other which bears comparison with it. When the tuberculous lesions are on the surface, the acid is rubbed into them with a sponge or other wad, after preliminary cleansing and anæsthetization when necessary; the earlier applications being twenty to forty per cent. in strength, soon and rapidly increased to from eighty to one hundred per cent. When the resultant eschar falls, as it should in a few days, the process is repeated; and so on until cicatrization is in progress. When the tuberculous lesions are confined in circumscribed masses enclosed within intact mucous membrane, the membrane is first to be incised, as recommended by Heryng, to give the acid access to the tuberculous masses. Lactic acid is of no use on the unbroken mucous membrane. When granulations project or tumors are present, or circumscribed tumefactions permit of it, these tissues are either scraped raw or are excised with sharp curettes (Heryng), or double curette gouge, or forceps (Krause), much like the Mackenzie forceps for morbid growths. Cicatrization of tuberculous ulceration after such treatment has been occasionally demonstrated in the dead subject. Cicatrization has also been demonstrated, but still less frequently, as a result of spontaneous processes. Cicatrization after lactic acid is sometimes permanent, but it does not protect the patient from subsequent local disease at that point, nor at any other.

This treatment is judicious, and should be instituted whenever practicable. It will give more good results than any other. Electric cauterization is to be condemned as a routine practice: except under the most skilful manipulation it will be injurious almost without a doubt.

Injections into the larynx of twenty-per-cent. solutions of menthol in olive oil, as recommended by Rosenberg, or in liquid vaseline or similar product, may be made daily in quantities as great as two drachms and a half. As the syringe is withdrawn from the mouth the patient should take a deep inspiration, which draws the volatile portions of the mixture at least some distance into the air-tract, whence it is slowly evolved again during the expiratory phases of the respiratory movements. This treat-

ment is more efficacious in the pulmonic areas of tuberculous ulceration than in the purely laryngeal ones.

Exalgine in four-grain doses twice a day is said¹ to be very efficacious in relieving pain and odynphagia in aryteno-epiglottic œdema of laryngo-pulmonary tuberculosis. Topical applications of a four- or five-per-cent. solution of cocaine hydrochlorate may be applied a few minutes before eating in cases in which that drug is not counterindicated constitutionally. An ointment of cocained cosmoline of the same strength may be swallowed from the end of a throat-brush and thus coat the tender places with an anæsthetic lubricator.

Harassing cough due to ulceration may often be repressed by insufflations of morphine, one-sixteenth to one-half a grain, as may be. Codeine or codeine sulphate given in doses not exceeding half a grain has excellent constitutional effect in producing sleep otherwise disturbed by the harassing cough. This drug, it is claimed, has some special influence on the tract of the pneumogastric nerve.

When swallowing is impracticable in ordinary positions, if the patient will lie on his stomach with his head and arms free over the end of the bed, sofa, or lounge, his feet being higher than his trunk, he will often be able to suck or siphon up water and liquid nourishment through a tube reaching from a tumbler held below his head, as recommended by Wolfenden.

Superabundant secretions may be removed by spraying the larynx at intervals with detergents, such as sodium bicarbonate or borate, two or three grains to the ounce of rose-water, tar-water, or other menstruum, which may be rendered quite pleasant to the parts by the addition of a few drops of good cologne-water or toilet vinegar. When dyspnoea is due to mechanical obstruction, whether by presence of a foreign body, new growths, webs across the glottis, exuberant granulations, escape of cartilage, or other local pathological product, appropriate surgical procedures may be necessary as in similar conditions unassociated with tuberculosis. Tracheotomy becomes necessary in this way in some cases, and may often be the means of prolonging life for several months, and occasionally for years.

Tracheotomy has been proposed as a direct therapeutic measure to place the larynx at rest and thus prevent cough to a certain extent. I have not found that it lessens cough to an extent to justify its performance for that measure solely. Indeed, in most of the cases in which I have performed tracheotomy to avert death by suffocation, cough has been fully as severe as it was before the operation, and in some instances more severe.

Further topical treatment will be chiefly symptomatic and on the lines pursued in ordinary chronic laryngitis.

¹ Desiré, New York Medical Abstract, November, 1891.

PART II.

SYPHILIS OF THE LARYNX.

Primary syphilis of the larynx may be dismissed from consideration in this volume.

Distinctions between secondary and tertiary syphilis are by no means so definite in the larynx as in other organs. Secondary lesions are sometimes late in their manifestations. Tertiary lesions are sometimes very early. Hence there are crossing-points at which it is impossible to make the differentiation. Secondary laryngeal lesions sometimes precede the cutaneous ones, but usually they are later, and in some instances they are the sole objective evidences of secondary syphilis. Tertiary lesions are sometimes noted in cases with complete absence of any clinical history of secondary lesion.

PATHOLOGY.

Erythema with turgescence of the mucous membrane but without secretion, and occurring within six to ten weeks after primary infection, is the earliest and most frequent pathological manifestation. At first it is diffusely rosy. Infiltrations and blood stases and transudations soon occur, marked by more or less lividity of the mucous membrane in patches with mottled discoloration. Denutrition of the epithelium from pressure may follow, leading to superficial erosions. Deeper denutrition may lead to extensive ulceration. Similar erosions and ulcerations may ensue from disintegration of papules or mucous patches, which, however, are not frequent laryngeal manifestations of syphilis. They are usually multiple, recurring frequently during a period of from three to five or more weeks, and are almost invariably accompaniments of mucous patches on mucous membranes elsewhere. They are more frequent in tuberculous individuals than in the non-tuberculous. They are most frequently observed at periods varying from three or four weeks to three or four months after primary infection; sometimes still earlier; occasionally far later, even to the eighteenth month. Histologically consisting in small-celled infiltrations into the corium and into dilated hypertrophied papillæ, they do not occur in localities devoid of papillæ. Hence they cannot occur below the vocal bands.

Red when recent, they change to light gray as the epithelium thickens, when they become opalescent ovoid wrinkled elevations less than a small pea in size, sometimes very minute, circumscribed with an inflammatory areola when recent, and depressed in the centre when mature. Sometimes they undergo complete absorption without disintegration, sometimes erosion, sometimes destructive ulceration. They may give rise to punctate or to dentate vegetations, histological papillomata, which repullulate when torn away, and which may so increase in bulk as to impede respiration.

Fluxionary œdema, too, may threaten suffocation, being caused by sudden exposure to cold. All the tissues in which these products appear may become thickened and eroded. When the vocal bands are so affected, a peculiar tooth-like irregularity of their edges is very characteristic. Secondary lesions rarely extend below the larynx.

Tertiary lesions usually commence as gummous infiltrations, as gummous nodules, or as true gummata. These products undergo liquefaction with ulceration. The epiglottis is by far the most frequent seat of these lesions, but no portion of the larynx possesses any immunity. Slight exposure to cold and irritation may produce fluxionary œdema with results most serious. Ulceration may be serpigiously superficial or deep-seated. Its phagedænic ravages may extend to all the tissues. Serious hemorrhage may be thus unexpectedly and suddenly produced; while apnœa may ensue from impaction of fragments of necrosed tissues. Proliferating vegetative growths may be developed at the seat of ulceration, and become large enough to occlude the air-passages.

Superficial ulceration may heal with hardly noticeable cicatrization. Deep and extensive ulceration heals under the production of characteristic, white, lustrous, stellate, and retractile cicatrices similar to those from burns. Adhesions may take place between adjacent raw surfaces, and strictures of various forms be thus produced. The vocal bands may become adherent to each other in this way to almost any extent, occasionally their entire length, with but a minute orifice for respiratory purposes. Such union has been known to take place in six days, but it usually requires several weeks. In some instances a membrane becomes formed in consequence of the continual stretching the new tissue undergoes in the inspiratory phases of respiration. The epiglottis may become adherent to the aryteno-epiglottic fold, to the pharyngo-epiglottic fold, or to the pharyngeal wall; the ventricular band to the vocal band, or to its own fellow; the inner surfaces of the mucous membrane over the arytenoid cartilages to each other; and so on. Other results are hypertrophies, circumscribed or diffuse, of mucous membrane, connective tissue, and muscular substance, with more or less consequent stricture; myopathic paralyses; atrophy of muscle; and the development of morbid growths. Perichondritis and chondritis may be developed, and they produce the same physical effects as have been described under tuberculous laryngitis. In addition they usually cause extensive fibrinous exudation into adjacent connective tissue with consecutive fibrinous œdema which may become extensive enough to threaten suffocation. In some cases these fibrinous products become organized into permanent dense fibrous tissues producing deformity, occlusion, and stricture. The strictures vary infinitely in configuration, sometimes almost distorting the natural outlines out of recognition. False and true ankylosis of the crico-arytenoid joint may follow as a result of the syphilitic process, although the arthritis itself may have no specific feature about it. Indeed, most ankyloses of this joint occur in syphilitic

subjects. When the specific process invades the joint, as sometimes it does, the ligaments and the perichondrium succumb, and there may be true ankylosis, or luxation or disarticulation, or even discharge of the arytenoid and supra-arytenoid cartilages.

Myopathic paralyses may occur in the tertiary period or late in the secondary period of syphilis. They are most frequently unilateral. The left side is affected the more commonly. They often occur suddenly after sudden or unwonted exposures to cold and to dampness. The paralysis often affects the dilator muscles of the larynx, and in this form is not infrequently bilateral. Paralyses of the arytenoid muscle and of the entire constrictor group are the most frequent varieties. Other paralyses in syphilis may be due to compression of a nerve by diseased tracheo-bronchial glands or other structures; or to neural and cerebral lesions which occur in the later stages of tertiary syphilis. Lesions of the trachea, of the bronchi, of the lungs, of the pharynx, of the palate, of the tongue, etc., are sometimes associated with those of the larynx; sometimes in continuity as far as concerns contiguous structures.

SYMPTOMATOLOGY.

The symptoms of secondary syphilitic laryngitis are by no means characteristic of the nature of the malady. Impairment of voice exists, and used to be termed *raucedo syphilitica*, but there is no peculiarity entitling it to be so termed. There may be hoarseness of various grades, and occasional temporary or permanent aphonia according to the location and character of the lesion when of inflammatory origin, or to the paresis or paralysis of one or more muscles. Dyspnoea and stridulous respiration may occur in the presence of œdemas and of organic tumefaction. Dysphagia may ensue from œdema or infiltration interfering with the act of swallowing. Cough and pain are less frequent than in other inflammatory lesions. Many cases are totally devoid of tickling, cough, pain, dyspnoea, and dysphagia.

The symptoms of tertiary syphilis of the larynx are usually impairments of voice, followed in severe cases by dyspnoea and stridor. The stridor is chiefly inspiratory, and is worse during the night-time. Suffocation may ensue suddenly from impaction of discharged cartilage, rarely from sudden œdema. Tickling and cough are more frequent in the earlier stages than in secondary syphilis, but they subside more or less after ulceration has taken place, occurring only when mucus, pus, or other morbid product becomes adherent and requires detachment. Pain rarely occurs before ulceration has commenced. Then it may become intense, and will radiate to the ears when the lower lateral edge of the epiglottis or the pharyngo-epiglottic fold becomes ulcerated, as is the case in all ulcerative lesions at those points. Expectoration does not take place until collateral catarrhal products accumulate, and for a long time it is catarrhal only. When ulceration begins the expectoration becomes muco-purulent, and as

that process progresses it becomes purulent, sanguineo-purulent, and mixed with detritus. When gangrene takes place the expectoration becomes fetid, and contains fragments of dead tissue, soft or cartilaginous, as may be. When the lesion occupies a position which exposes it to compression during the act of swallowing there will be mechanical dysphagia, and when ulceration exists there will be pain too, or odynphagia.

In hereditary syphilis the symptoms may exist from birth and may remain continuous for many years. Both respiration and phonation are usually affected. The cry of the infant often has a metallic tone which has been likened to that of a tin trumpet. Cough is more frequent in the child than in the adult. Swallowing is often difficult and sometimes painful. The products of secretion are swallowed by young infants, but are expelled by expectoration as the child grows older. Laryngismus is frequent in young children.

ETIOLOGY.

The probable exciting cause inducing specific manifestations of constitutional syphilis in the larynx is a superficial catarrhal laryngitis of ordinary origin, whether from change of temperature and humidity, from abuse of alcohol, tobacco, or dietary condiment, from abuse of the voice, from hereditary delicacy of the parts, or what not. Men are far more frequently affected than women, as they are more exposed to vicissitudes of weather and of the table and the bar-room. Sexually the absorbent tissues at the usual seats of initial lesion ought to render the female far more liable than the male to the constitutional results of syphilis. Hereditary syphilis has been observed in the fœtus, and is not uncommon in very young infants. Ulcerative laryngeal lesions have been observed as early as the age of two months. It is not infrequently manifested at five or six years of age, and is occasionally deferred until puberty or a little later. I firmly believe that I have seen cases of hereditary syphilis with laryngeal lesions commencing as late as the third and even the fourth decennium.

Secondary syphilis of the larynx is most frequent in adolescents and young adults, and at periods varying from a few weeks to a few months after the primary infection, but has also been observed exceptionally at much later periods, fourteen to seventeen months in some instances. Tertiary lesions are usually observed in the young and middle-aged adult, and only occasionally in advanced life. They have been noted as early as the sixteenth month after infection, and as tardy as the thirtieth and exceptionally the fiftieth year and even later. They occur not at all infrequently after every ordinary manifestation of the disease has for years subsided with apparent permanence. Some breaking down of the patient's health then seems to allow fermentation, if one may so speak, of some dormant but intact germs which have remained quiescent because the healthiness of the subject deprived them of material suitable for development.

DIAGNOSIS.

Syphilis of the larynx is often difficult to discriminate from tuberculosis, lupus, carcinoma, and some other lesions, especially in the complete absence of corroborative indications in other structures. The differentiation of secondary syphilis from tertiary is especially difficult in the transitionary period, in late secondary manifestations, and in early late ones.

Secondary lesions are superficial. They comprise erythema, papules, and condyloma of the mucous membrane, and superficial paralyses. Tertiary lesions are mostly deep-seated. They comprise gumma, gummatous infiltration, ulceration, caries, necrosis, exuberant overgrowths, and strictures. Lesions which occur before the termination of the third year may be regarded as most probably secondary. Those occurring within the third year may be regarded either as secondary or as transitional. Those occurring after the third year are to be regarded as tertiary. Exceptions occur. Thus, secondary lesions may become ulcerous. Tertiary lesions have been recognized within nine months after primary infection.

Laryngoscopic inspection is indispensable as an aid to diagnosis. I have known carcinoma of the larynx to have been overlooked again and again simply because some self-sufficient practitioner has taken it for granted that a laryngitis in a patient who confesses to syphilis must be a syphilitic laryngitis. This is an erroneous belief. Again, a syphilitic subject may beget tuberculosis just as a tuberculous subject may beget syphilis, and when the matured lesions of both are apparent at the same time there is often considerable difficulty in recognizing the coexistence of the two diseases. A syphilitic subject may beget carcinoma likewise. My observations for many years have shown me that many cases of carcinoma of the larynx and of the tongue, the two organs with whose carcinomatous clinical history I am most familiar, originate upon a syphilitic basis. In like way tubercle in a subject without appreciable pulmonary lesion or totally without it is liable to be mistaken for syphilis.

In all doubtful cases an anti-syphilitic constitutional treatment should precede or accompany the topical treatment. Improvement follows so closely upon the constitutional treatment in almost every case of syphilis as to clearly indicate its nature. But this is not invariable. Sometimes one plan of constitutional treatment will fail. The diagnosis being in doubt, other treatment will be applied and fail. Then a second, or in some instances a third, institution of anti-syphilitic treatment in a different manner will clear up the syphilitic diagnosis and justify the doubter. There is little risk, and often none at all, in injuring a case of tuberculosis by the preliminary anti-syphilitic treatment, unless it should be instituted in a case so far advanced as to be characteristic, and therefore not in need of differentiation by constitutional measures.

There are several manifestations of secondary syphilis which are not characteristically diagnostic. Thus, diffuse erythema and diffuse catarrhal

PLATE I.

SYPHILIS OF THE LARYNX, ESPECIALLY OF THE VOCAL BANDS (J. SCHNITZLER¹).

Figures 1 to 4 show the early forms of syphilis of the larynx. The conditions represented in these four figures date from the fourth, the sixth, and the eighth week after infection.

Figure 1. Redness and swelling of the vocal bands; the left vocal band shows on its edge a dark-red spot which was sharply defined by a grayish-white line.

Figures 2, 3, and 4 show the varied forms of syphilitic papules on the vocal bands. These small, gray-white, mostly round or oval infiltrations are so characteristic that if once seen they are never forgotten.

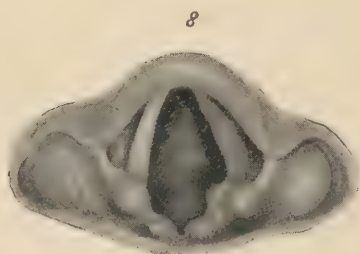
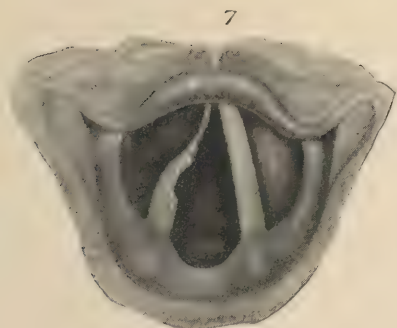
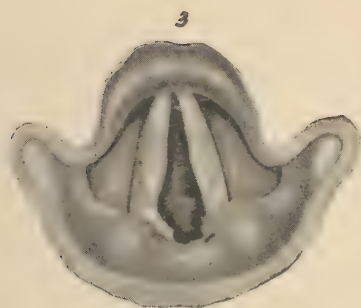
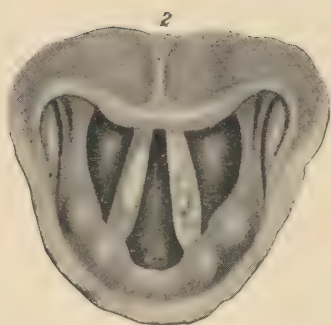
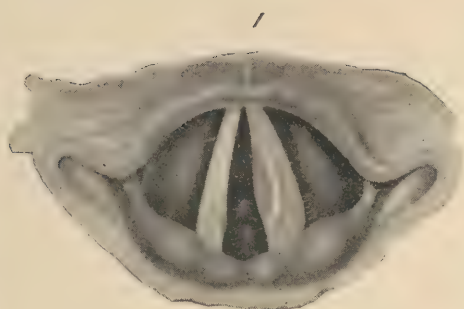
Figures 5 and 6. Appearances of the larynx several months after infection. Irregular ulcers on the vocal bands: characteristic appearances of syphilis of the larynx.

Figure 7. Comparatively circumscribed, but deep, syphilitic ulceration on the right vocal cord in process of healing.

Figure 8. Complete destruction of the left vocal band, the vocal process alone intact. On the left ventricular band distinct cicatrization. Cured after loss of entire left vocal band.

¹ These exquisite representations of the syphilitic process in the larynx, and of its cure, are reproduced from the colored plates accompanying the lamented Schnitzler's most recent work.

PLATE I.



inflammation of undoubted specific origin are not distinguishable from similar conditions undoubtedly non-specific. Circumscribed erythema which is usual in syphilitic laryngitis sometimes occurs in non-specific laryngitis. Shaded pigmentations at the extremities of the vocal bands are more frequent in syphilis, but they exist under other conditions likewise. Patches of erythema on the vocal bands and elsewhere may be regarded as characteristic of syphilis. Symmetric localization of erythematous patches is highly characteristic. Isolated bilateral congestion over the cartilages of Santorini and of Wrisberg has been regarded as pathognomonic of syphilis,—a most erroneous opinion.

Papules or condylomas upon an erythematous mucous membrane (Plate I., Figs. 2, 3, 4) may be classed as pathognomonic. It may require close and repeated inspection under an exceptionally good light to recognize them, and to differentiate them when small from minute collections of mucus or of saliva.

Tertiary syphilis is likewise in some instances difficult of diagnosis in its early stages. In the first place, inflammatory syphilitic infiltration is to be discriminated from diffuse gummous infiltration. Gummous infiltration of the larynx is likely to be accompanied by gummous manifestations elsewhere. It is more circumscribed in its outlines than is inflammatory infiltration, and is more sharply defined. The differential diagnosis becomes easy after liquefaction and ulceration of the gummous infiltrates (Plate II., Figs. 1, 2, 3, 4, 5, 7). Pronounced nodular syphilides and true gummata are usually readily recognized by the characteristic features mentioned under Pathology. They are sometimes mistaken for neoplasms of inflammatory and of constitutional origin other than syphilitic, and for inflammatory abscesses. Occasionally they are mistaken for condylomata.

Gummata have usually progressed through the stage of liquefaction and into that of ulceration before they come under the eye of a laryngoscopist not particularly engaged in treating syphilis. Hence many specialists rarely see them. In the early stages of ulceration diagnosis is not usually difficult. Syphilitic ulceration usually proceeds from above downward, and ulceration of the larynx is often but an extension of ulceration of the pharynx, sometimes in contiguity, sometimes the result of contact. Repair is usual in the reverse direction.

Advanced ulceration, especially in the presence of swollen and contorted structures, whether epiglottis, aryteno-epiglottic folds, ventricular bands, vocal bands, or what not, may be confounded with lupus, with tuberculosis, or with carcinoma, epithelioma especially. The presence or absence of pain is not a positive guide in diagnosis. There may be no pain in carcinoma, and pain may be intensely lancinating in syphilis. The general diathesis, the clinical history, the presence or absence of enlarged submaxillary and post-cervical glands, and, not least, the therapeutic history, are of service in discrimination.

The typical syphilitic ulcer is sharply defined and below the surface of

PLATE II.

GUMMATA AND PROFOUND DESTRUCTION OF TISSUE IN CONSEQUENCE OF BREAKING DOWN OF INFILTRATION. LATE STAGES OF SYPHILIS, MOSTLY SEVERAL YEARS AFTER INFECTION (J. SCHNITZLER).

Figure 1. Characteristic, irregular ulcers on the edges of both vocal cords; in addition a round, almost typical ulcer on the left arytenoid cartilage.

Figure 2. Irregular ulcer on the laryngeal surface of the epiglottis, left side, with beginning ulceration on the left vocal band and left arytenoid cartilage.

Figure 3. Ulcer on the left ventricular band, with lardaceous, purulent covering.

Figure 4. Intense swelling of the epiglottis: the latter is unrecognizable by reason of diffuse infiltration. Entrance to the cavity of the larynx entirely occluded. On the left half of the epiglottis, a deep, irregular ulcer with lardaceous covering: a second, crater-like ulcer on the outer surface of the right arytenoid cartilage extending to the ary-epiglottic fold.

Figure 5. Advanced syphilis of the larynx. Characteristic ulcers following breaking down of gummous infiltration on the edges of the epiglottis and on the outer surface of the arytenoid cartilage. Dirty-gray, deep ulcers, with lardaceous covering and circumscribed by sharply-defined edges.

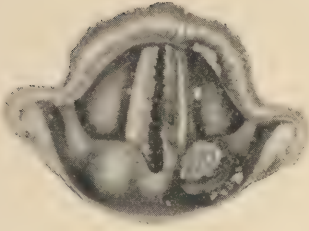
Figure 6. The same larynx after several weeks of anti-syphilitic treatment. Cure of ulcers, with great loss of tissue. Characteristic cicatrices.

Figure 7. Extensive and profound destruction of the larynx, especially of the epiglottis and arytenoid cartilage.

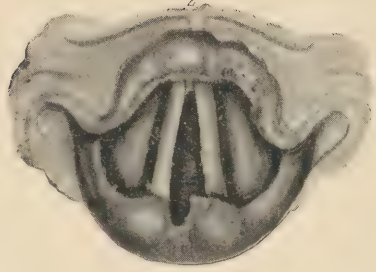
Figure 8. Same case, healed by systematic anti-syphilitic treatment.

PLATE II.

1



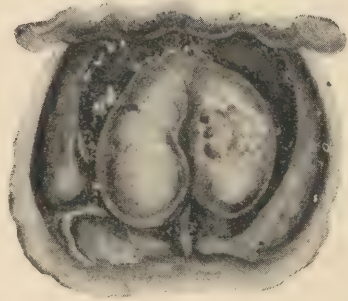
2



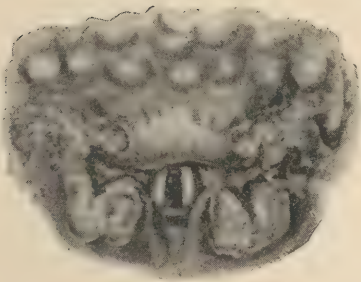
3



4



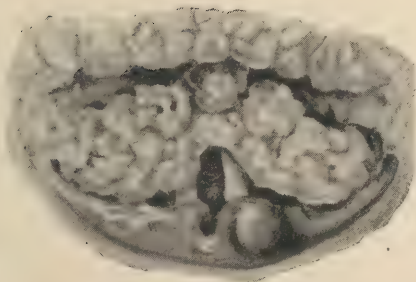
5



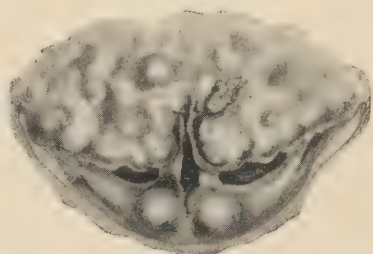
6



7



8



the mucous membrane, the circumscribing border of which is indurated and congested (Plate I., Figs. 5, 6; Plate II., Figs. 1, 3, 4). It is more or less crenated when undergoing repair (Plate I., Fig. 7; Plate II., Figs. 6, 8). The bottom is hard to the touch when probed. The bed is gray, lardaceous, or yellow, as may be, often covered with adherent clumps of pus, sometimes concrete. Advanced ulceration may give exposure to denuded or necrosed cartilage, or destroy a vocal band completely (Plate I., Fig. 8).

PROGNOSIS.

The prognosis is good in secondary syphilis. The lesions, even when ulcerative, are likely to heal without cicatrix. Ulceration of the vocal bands, however, may leave permanent defects in those structures, and then the singing voice will be more or less impaired. Temporary œdema renders the prognosis grave from that stand-point only, until the œdema has been subdued. Actual hyperplasias the result of inflammatory infiltrations rarely subside entirely, sometimes not at all, although every positive evidence of syphilis may have been subdued.

The prognosis is good, as a rule, in tertiary syphilis. But there are several conditions which lend the prognosis more or less gravity. Thus, œdemas, exfoliations of necrosed cartilage, acute bilateral paralysis of the dilator muscles of the larynx, ankyloses of the crico-arytenoid joint, inter-arytenoid and other obstructing gummata, all render the prognosis unusually grave for the time being, and may even require tracheotomy to avert death by suffocation. The cicatrizations of tertiary syphilis produce permanent glistening retractile scars which are very characteristic (Plate II., Figs. 6, 8).

Ulceration may complicate matters by opening into blood-vessels and by interfering with swallowing, especially liquids which may become diverted into the larynx. Swallowing is rarely permanently impaired, even when the epiglottis has been destroyed down to the level of the laryngeal orifice, the soft tissues around the opening acting as a sphincter and thus supplying the lost function of the epiglottis. Strictures occurring rapidly rarely impair the prognosis, as they yield readily to treatment; but strictures occurring slowly are rarely amenable to constitutional treatment, and usually require prolonged dilatation, catheterization, or intubation, in many cases associated with some cutting procedure. Death may ensue by suffocation from the lesion in the larynx, or by meningitis or some visceral lesion distant from the larynx. When paralysis of the dilator muscles of the larynx is due to cerebral lesion, death may occur from suffocation, if not averted by prophylactic tracheotomy, or from encephalitis with coma.

In hereditary syphilis the prognosis is much the same as in tertiary syphilis, but is very unfavorable in infancy and childhood on account of the smaller size of the larynx, which renders œdema and stricture far more serious, and on account of the tendency to spasm of the larynx. Deaths from these three causes, stricture, œdema, and spasm, are not very infre-

quent in the laryngeal syphilis of children and infants. Finally, there is an element of uncertainty as to the ultimate results, for recurrences in syphilis are not infrequent, no matter what the structure involved, how satisfactory the immediate treatment, or what length of time may have elapsed without new constitutional or local manifestation.

TREATMENT.

Except in the presence of lesions interfering mechanically with the functions of the larynx, constitutional treatment takes precedence of topical treatment. Ulcerative processes, and even proliferative ones, often heal promptly without any occasion whatever for any other topical interference than such as may be necessary or convenient for freeing the tissues from adherent secretory and excretory products. For this purpose detergent and emollient sprays may be employed. The inexperienced practitioner and the specialist unfamiliar with the general practice of medicine must be warned, therefore, against attributing to their manipulations of the larynx the beneficial results which occur while they are prescribing traditional constitutional remedies concerning which no one who has at all studied medicine can be ignorant.

The classic constitutional treatment comprises essentially medicinal preparations of mercury in the early manifestations, and preparations of the iodides in the late ones. In many late manifestations, however, probably in most of them, a mixed treatment combining mercurials and iodides will be found by far the more judicious.

Secondary lesions sometimes subside without leaving any trace, even though no mercurials be administered. On the other hand, no absolute immunity from tertiary lesions is sure to follow the use of mercury. Nevertheless, the better plan is to employ the mercurials. All topical irritation from stimulants, tobacco, overuse of the voice, and the like, should be avoided. Sedative inhalations in vapor or in spray are indicated in the presence of inflammations. When secondary lesions are moderately severe and progress but slowly, the corrosive chloride of mercury may be given in doses of from one-sixteenth to one-eighth grain three times a day, or the green iodide in doses of from one-sixth grain upward. In severe and rapidly progressing cases, and in individuals whose stomachs are intolerant to the mercurial by the mouth, inunctions of a drachm of the mercurial ointment (British Pharmacopoeia) are preferable. Instead of this the oleate of mercury in ten-per-centum solution may be pencilled upon similar portions of the skin; or hypodermatic injections may be made of the corrosive chloride in appropriate solution.

Topical medication of the larynx is usually superfluous in non-ulcerative lesions, and often unnecessary even in ulcerative lesions. In the presence of hyperplasias, topical applications of a solution of iodide in glycerin half a drachm to the ounce, with a drachm of potassium iodide, daily or every two or three days, hasten the cure.

In tertiary syphilis of the larynx and in its precedent transitional stage, the most efficient constitutional treatment that I have used is the mixed treatment with preparations of both iodine and mercury. One-sixteenth to one-eighth of a grain of corrosive chloride with five to ten grains or more of potassium iodide in half an ounce or more of the compound syrup of sarsaparilla three times a day will answer in most instances. If the results are not prompt, the iodide should be increased to the point of tolerance, which may not be reached until given in doses of thirty, sixty, and even ninety grains. When such large doses are being given, the larynx should be examined several times a day; for œdema of the larynx is every now and then caused by such doses, and, if neglected, the patient may be unnecessarily permitted to die suffocated. The œdema usually subsides upon withdrawal of the drug. In some patients sodium or ammonium iodide or hydriodic acid may be found more efficacious than potassium iodide. In œdema occurring independently of the medication and apparently due to stases in the circulation, if the case be not sufficiently urgent to demand surgical interference, hypodermatic injections of one-thirtieth of a grain of corrosive chloride, the method employed by Lewin, of Berlin, twice a day for a day or two, and then at intervals of three or more days, will sometimes be found very satisfactory. Should the œdema increase, however, or fail to begin to subside within forty-eight hours, it will be more prudent to perform prophylactic tracheotomy than to trust further to medication. The same line of conduct should be pursued in the presence of extensive hyperplasias, whether specific in nature or only collaterally inflammatory.

Active inunction with mercurial ointment is sometimes fully as efficacious as hypodermatic injection in the presence both of œdema and of hyperplasia. Intubation of the larynx after the method of O'Dwyer is said to be applicable in many instances of œdema and of hyperplasia. I have had no experience with the method.

Ulceration, even when extensive, often heals promptly under constitutional treatment without any topical medication whatever. Should the process be tardy, it may be stimulated by cauterization with fused silver nitrate, with mercuric nitrate one part in from four to ten parts of water, with cupric sulphate in crystal, which is my favorite treatment, or in solution, or with chromic acid one part in from four to ten parts of water. Insufflations with iodoform or one of its many substitutes are sometimes very beneficial and seem to accelerate the healing processes.

Paralyses, even those of the posterior crico-arytenoids, are usually amenable to anti-syphilitic treatment, even when of considerable standing. This fact seems to indicate that the atrophy found in neurotic paralysis is not due to simple inaction of the muscle, but rather to trophic impairments of neurotic origin. Electrization may be employed when relief does not ensue from systemic medication.

Vegetations, detached flaps of mucous membrane, and semi-detached

fragments of necrosed cartilage call for operative removal with cutting forceps, evulsion forceps, or snares, as may be most convenient, when these products are so located as to interfere with freedom of respiration or to threaten such interference. When these manipulations are impracticable, tracheotomy may be requisite. When tracheotomy has been performed under any of the conditions mentioned, the canula is to be removed as soon as it has become apparent that its retention is no longer essential to the safety of the patient. Cicatricial stricture of the larynx may be treated by the introduction of the intubation-tube through the natural passages (O'Dwyer). From recent observations, I fear that intubation will fail unless supplemented by occasional incision and divulsion.

Membranous webs occluding the glottis from side to side are to be divided by incision or by electric cautery, the edges cauterized, and readherence prevented, if possible, by frequent introduction of dilating sounds. These laryngoscopic operations are often rendered futile by insurmountable tendency to recicatrization, whereby the morbid condition is reproduced. Success in cases of this kind would seem to require exposure of the interior of the larynx by external division of the thyroid cartilage, and excision of the whole of the cicatricial tissue.

Threatened asphyxia or unconquerable dyspnœa, from gumma, loose cartilage, morbid growth, abscess, or œdema, may necessitate tracheotomy. Tracheotomy for the purpose of conquering dyspnœa due to tumefactions in the larynx is perfectly justifiable, and usually successful. It is likewise justifiable for the mere purpose of securing rest to the organ,—much more so, indeed, than in analogous conditions attending tuberculosis.

When syphilitic laryngitis has been of long standing, such an amount of destruction may have taken place, and such a degree of systemic poisoning exist, as to render recovery impossible. The constrictions produced by the cicatrices of extensive ulcers, and the adhesions between adjoining surfaces, in cases that recover, are often such as to render tracheotomy necessary, with the permanent use of the tube; for the constrictions following syphilis are not, as a rule, amenable to dilatation.

The treatment for local adhesions consists in relieving the tension as far as possible by laryngoscopic division of the constricting bands of tissue with knife or with electric cautery, and then cauterizing and recauterizing the adjacent surfaces, to prevent fresh adhesions. These cases require careful watching and prompt attention to overcome the disposition to recurrence, which is very apt to take place in spite of all efforts. When the epiglottis is implicated, much good can be done by teaching the patient to move the organ frequently with his forefinger.

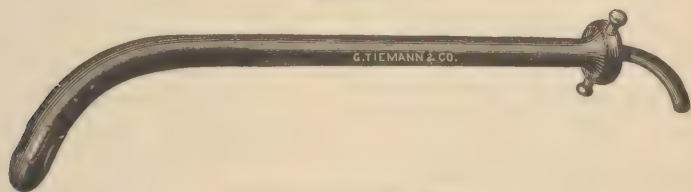
Despite the most judicious treatment and the most satisfactory immediate results, recurrence or recrudescence takes place in many instances at variable intervals, requiring resumption of specific treatment. The most satisfactory results claimed by any writer have been in cases actively treated by Lewin with hypodermatic injections. It is advisable to keep patients

under observation for many months after active treatment has been discontinued. Mercuric iodide (biniodide) in small doses, one-twentieth to one-tenth of a grain, three times daily, may judiciously be given for prolonged periods during which apparent health exists. Potassium iodide, in diminishing doses, should be administered from time to time for a few days every month until the patient begins to show susceptibility to physiological effects from small doses; and then this susceptibility should be tested from time to time at intervals of a few months. Such supervision for two years at least seems to present the best prospect for riddance from the diathesis.

The treatment of the permanent strictures which follow in sequence of cicatrizations of syphilitic ulcers is usually long and tedious. Of late years a good deal has been reported in favor of the use of intubation-tubes devised by O'Dwyer, of New York. I have had but a few opportunities of using this treatment, and they were not favorable cases. The use of the tracheotomy canula could not be dispensed with.

Systematic dilatation with catheter-like bougies which are retained for longer or shorter periods on the same principles followed in the dilatation of the urethra are applicable to strictures of the larynx. In many cases preliminary incisions of the cicatrix at one or more points of its surface are necessary prerequisites. These are made with laryngeal knives, open or guarded, according to the skill or confidence of the surgeon. The best dilators are those (Fig. 16) devised by Professor von Schroetter, of Vienna, which are modelled upon the normal shape of the opening of the glottis,

FIG. 16.



Schroetter's laryngeal dilator.

and which are inserted at first by the medical attendant and subsequently by the patient himself. An instrument of as large a calibre as can conveniently be passed is introduced and allowed to remain a few minutes or many minutes according to the tolerance of the parts. It is then withdrawn, and a second instrument one size larger substituted and retained for a few minutes. This is done daily until finally a limit has been reached, and the corresponding catheter is introduced daily for many months in order to maintain the calibre acquired by its use. From six to eighteen months are required in most cases to secure even an approximative cure of a bad stricture of syphilitic origin. Many of them are utterly incurable.

It may be mentioned in conclusion that, under intercurrent attacks of erysipelas, obstinate cases of tertiary syphilis of the larynx and trachea have undergone cure after having resisted all medicinal treatment.

INDEX TO VOLUME II.

A.

- Abscess of nose, 65.
 retro-pharyngeal, 301.
 Acne of nose, 173-175.
 "Adam's apple," 198, 199.
 Adenoids, nasal, 61.
 Adenomata, larynx, 758, 759.
 nasal cavities, 13.
 Age, in hay-fever, 72.
 Amblyopia caused by galvano-cautery in nose, 169.
 from nasal disease, 155.
 Ametropia cause of "common cold," 171.
 cause of nose-bleed, 171.
 Anæsthesia, local, in nasal surgery, 40.
 of larynx, 671, 672.
 Anæsthetics, general, in nasal surgery, 40.
 Angina arthritica, 273.
 catarrhalis acuta, 250-259.
 croupous (benign), 270, 271.
 nosocomii, 266-268.
 rheumatic, 272.
 ulcerosa, 266-268.
 Angioma, cavernous, nasal, 62.
 nasal cavities, 16.
 Angiomata, larynx, 759-761.
 nasal, 61, 62.
 Anosmia, 92-97.
 Antisepsis of the nose, 39-41.
 Aphthous sore throat, 270, 271.
 Aprosaxia from nasal disease, 135, 136.
 reflex nasal, 135, 136.
 Arnold, Jacob D., A.M., M.D., on acute laryngitis, 305-327.
 "Ary-epiglottic" fold, 203.
 Aryteno-epiglottic fold, 203.
 Arytenoid cartilages, 200.
 muscle, 206.
 Asthenopia from nasal disease, 153, 156.
 from swollen turbinates, 169.
 psychic, from nasal disease, 156.
 reflex nasal, 129.
 Asthma, 129.
 from nasal disease, 115-126.
 from neuroses of nose, 102.
 reflex nasal, 115-127.
 Astigmatism from nasal disease, 153.
 Asymmetry of nasal bones, surgery of, 65.
 Atresia, nasal, congenital, 65.
 Atrophy of conjunctiva from atrophic rhinitis, 160.

B.

- Bean, C. E., M.D., on acute tonsillitis, 274-284.
 Blepharospasm from adenoids in naso-pharynx, 168.
 Blindness from pressure in nasal disease, 158.
 Bosworth, Francke H., M.D., on hay-fever, 66-89.

- Bronchial septum, 509.
 Bronchus, foreign bodies in, 509-511.
 Browne, Lennox, F.R.C.S. Ed., on deformities and morbid growths of the pharynx and larynx, 709-791.
 Bulkley, L. Duncan, M.D., on skin-diseases of the nose, 173-191.

C.

- Caries, nasal, surgery of, 64.
 Catarrh, chronic laryngeal, traumatic, 479-481.
 Caustics, chemical, in nasal hypertrophy, 41.
 Cautery, electric, in nasal hypertrophy, 42, 43.
 Chapman, S. Hartwell, A.M., M.D., on vocal culture and hygiene, 212-247.
 Chest-capacity in vocal culture, 238, 239.
 Chink of the glottis, 204.
 Chondromata, nasal cavities, 16-18.
 Chorditis tuberosa, 473.
 vocalis hypertrophica inferior, 485.
 Chorea, larynx, 678-683.
 reflex, from nasal disease, 133-135.
 Choroid, congestion of, from nasal disease, 169.
 Clamp-splint, nasal, 57.
 Cocaine in nasal surgery, 40.
 Cohen, J. Solis, on tuberculosis and syphilis of the larynx, 792-825.
 "Cold in head" caused by ametropia, 171.
 Conjunctivitis from adenoids in naso-pharynx, 168.
 from nasal disease, 155.
 Corneal inflammation from nasal disease, 159.
 ulceration from cæna, 161.
 Corneitis from adenoid growths in naso-pharynx, 168.
 Cornicula laryngis, 201.
 Cough from nasal disease, 109-112.
 neurotic, 109-112.
 Crico-arytenoid articulation, 202.
 ligament, 202.
 Cricoid cartilage, 200.
 Crico-thyroid membrane, 202.
 Crico-tracheal ligament, 202.
 Croup, 328-343.
 intubation, 390-396.
 laryngismus stridulus, 336-339.
 membranous, idiopathic, 328-334.
 spasm of the glottis, 336-339.
 in adults, 339-342.
 spasmodic, 334-336.
 laryngitis, 334-336.
 surgical anatomy of the pre-tracheal space, 396-399.
 treatment, 390-411.
 tracheotomy, 396-401.
 choice of operation, 401.
 Cystomata of larynx, 759.

D.

- Dacryocysto-blennorrhœa** from atrophic rhinitis, 165.
 from disease of nasal septum, 165.
 from hypertrophy of turbinates, 165.
Deformities, nasal cavities, 37, 38.
Deglutition, 197, 198.
De la Sota y Lastra, Ramon, M.D., Ph.D., LL.D., on lupous and leprous laryngitis, 412-456.
Diphtheria, 343-390.
 age of patients, 349-351.
 bacillus, 343-345.
 diagnosis, 357-359.
 differential diagnosis, 359-363.
 diphtheritic exudate, 359.
 diphtheroid, 360.
 incubative period, 351, 352.
 intubation, 390-396.
 microbe, 343-345.
 modes of propagation, 352-357.
 prophylaxis, 363-369.
 pseudo-diphtheria, 345, 349, 360.
 treatment, 369-389.
 hygienic, 369-371.
 internal, 378-389.
 local, 371-378.
 surgical, 390-411.
 tracheotomy, 396-401.
 vitality of Klebs-Löffler bacillus, 348.
Drills, surgical, in deformities of septum, 53-56.
Dysphagia, 704-708.

E.

- Ear**, reflexes in, from nasal disease, 128.
Echondrosis, nasal cavities, 29, 30.
Écraseur for nasal adenoids, 61, 62.
 nasal, in hypertrophies, 44.
 septum-operations, 50, 51.
Eczema of nose, 175-177.
Emphysema of skin, inner canthus, from blowing nose, 157.
Empyema of antrum of Highmore cause of eye-disease, 155.
Enchondroma laryngis, 482.
Enchondromata of larynx, 761, 762.
Epiglottis, 195, 200.
 crest of, 203.
 cushion of, 203.
 tuberculous ulceration, 793.
Epiglottitis, acute miasmatic, 313.
Epilepsy from nasal disease, 135, 136.
 reflex nasal, 135, 136.
Epiphora from nasal disease, 155, 164.
 from *ozæna*, 163, 164, 172.
Epithelioma of the nose, 177-179.
Epitheliomata of larynx, 773-778.
 (carcinomata) of pharynx, 731-734.
Erectile tissue, nasal cavities, 5, 6.
 tumors, nasal cavities, 15, 16.
Eruptions on the nose from bromide and iodide of potassium, 191.
Erysipelas of the nose, 179, 180.
 of the pharynx, 268.
Erythema of the nose, 180.
Excision in nasal hypertrophy, 43-47.
Exostoses, nasal cavities, 31, 32.
Eye, diseases of, dependent upon diseases of the nose, 149-172.
 accessory nasal cavities, 164.
 adenoid growths in naso-pharynx, 168.
 asthenopia, 153.
 astigmatism, 153.

Eye, diseases of, dependent upon diseases of the nose:

- atrophic rhinitis, 161, 165.
 atrophy of optic disk, 154.
 congenital optic atrophy, 153.
 cornea, 156.
 diseases of ethmoid, sphenoid, the frontal and maxillary sinuses, 154-157.
 of lachrymal excretory apparatus, 162.
 of middle turbinate, 158.
 empyema of antrum of Highmore, 155.
 of maxillary sinus, 156.
 ethmoidal sinuses, diseases of, 154.
 evils of prolonged use of cocaine in the nose, 156.
 from disease of the sphenoidal sinuses, 154.
 gonorrhœal nasal cavities, 159.
 hydrops of frontal sinus, 165.
 hypertrophy of lower turbinates, 160.
 in strumous nasal organs, 159.
 indirect nasal origin, 168-171.
 Leber's disease, 153.
 mechanically-caused abnormality of the eyes starting in the nose, or in communicating and adjacent structures, 157, 158.
 middle turbinate, 162.
 nasal cautery, 164.
 hydrorrhœa, 155, 156.
 tumors, 158, 165, 168.
 necrosis of os planum, 155.
 of sphenoidal sinuses, 156.
 ocular lesions caused by the transfer of pathogenic material from the nose to the eye by way of the lachrymal canal, 158-162.
ozæna, 159.
 presbyopia in children, 153.
 rhinitis, 160.
 syphilitica, 163.
 sneezing, 157.
 strabismus, 153.
 supra-orbital neuralgia, 155.
 tumors of sphenoidal sinuses, 157.
 reflexes in, from nasal disease, 128-131.
Eyeball, disease of, from nasal tumors, 168.
 expression of, by tumors of sphenoidal and ethmoidal sinuses, 157.
Eye-diseases, reflex nasal, 128-131.
 secondarily affecting the nose, 171-173.

F.

- Fauces**, 192.
Fevers, larynx and pharynx in, 622-663.
Fibro-cellular growths, 757, 758.
Fibroids, nasal cavities, 12, 13.
Fibromata of larynx, 756, 757.
Fissura mucosa inter-arytenoidea, 315.
Foreign bodies in the bronchi, 509-511.
 larynx, 500-533.
 nasal cavities, 32-35.
 surgery, 51-53.
 œsophagus, 533-570.
 pharynx, 533-570.
 trachea, 500-533.

G.

- Glasgow, William Carr, M.D., on croup, 328-343.
 Glaucoma from nasal disease, 156.
 from ozæna, 159.
 Glosso-epiglottic ligament, median, larynx, 202.
 Glottis, spasm of, in adults, 339-342, 677, 678.
 in children, 336-339, 674-677.
 Gonorrhœa, nasal cavities, 159.
 Gould, George M., A.M., M.D., on diseases of the
 eye dependent upon diseases of the nose, and
 reflex nasal disease due to ocular maladies,
 149-172.
 Gout as cause of hay-fever, 73.
 Gouty sore throat, 273.
 Granular lids with disease of lower turbinates,
 160.
 Graves's disease from nasal disease, 137, 138.
 reflex nasal, 137, 138.
 Gummata, larynx, 818.
 nasal cavities, 21-23.

H.

- Hæmatoma of nose, 65.
 Hæmostatic clamp (Jarvis's) in nasal surgery,
 51.
 Hay-fever, 66-89.
 age, 72.
 course, 78.
 definition, 66, 67.
 diagnosis, 81, 82.
 duration, 79, 80.
 etiology, 67, 73.
 from eye-disease, 172.
 geographical distribution, 80, 81.
 gout in, 73.
 history, 66, 67.
 nasal disease in, 70-73.
 neurosis, 73.
 neurotic habit, 70.
 pathology, 73-75.
 pollen as cause, 68, 69.
 prognosis, 82, 83.
 psychic influence in, 72.
 symptomatology, 75-78.
 treatment, 83-89.
 Headaches, reflex nasal, 131-133.
 Heart, reflex nasal irritation, 137.
 Hemorrhage in nasal operations, 40.
 retinal, from sneezing, 157.
 subconjunctival, from nasal irritation, 157.
 Herpes of pharynx, 270, 271.
 Hiccough from nasal disease, 113.
 Hyo-epiglottic ligament, larynx, 201.
 Hyoid bone, 199.
 Hyperæsthesia of larynx, 670, 671.
 nose, 107, 108.
 Hyperosmia, 91.
 Hyperosphresia, 91.
 Hyperplasias, nasal cavities, 26-29.
 Hypertrophies, nasal cavities, 27-29.
 posterior, surgery of, 45.
 Hypertrophy of turbinated tissue, surgery of,
 41-47.
 Hysteria, nasal reflex, 140-142.

I.

- Ingals, E. Fletcher, M.D., on chronic pharyn-
 gitis, 284-304.
 Intubation of larynx, 390-396.
 Iritis from empyema of antrum of Highmore,
 155.
 from nasal disease, 158.
 from ozæna, 159.

J.

- Jarvis, William Chapman, M.D., on surgical pro-
 cedures in deformities and neoplastic growths
 in the nose, 39-65.

K.

- Keratitis from nasal disease, 160.
 from ozæna, 159, 161.
 Knife, in septum deformities, 48.
 Knight, Charles H., M.D., on chronic disease of
 the tonsils, 571-621.

L.

- Lachrymal canal, compression of, from nasal
 disease, 165.
 duct, compression of, from malignant tumors,
 165.
 excretory apparatus, diseases of, from nasal
 disease, 162.
 inflammation of, from nasal
 disease, 162.
 obstruction from chronic nasal catarrh, 165,
 166.
 from disease of middle turbinated bone,
 158.
 from nasal disease, 158.
 treatment, 166-168.
 sac, compression of, from nasal disease, 164,
 165.
 Lachrymation from nasal disease, 163.
 reflex nasal, 128.
 Laryngeal paralysis from disease or injury of
 the inferior (recurrent) laryngeal
 nerves, 685-688.
 from disease or injury of medulla and
 nucleus of spinal accessory nerve, 683,
 684.
 from disease or injury of pneumogastric,
 684.
 from disease or injury of superior laryn-
 geal nerve, 684, 685.
 spasm in the adult, 342.
 Laryngismus stridulus, 336-339.
 reflex nasal, 114.
 Laryngitis, acute, 305-327.
 epiglottitis, acute "miasmatic," 313.
 etiology, 305-310.
 " fissura mucosa inter-arytenoidea,"
 315.
 in young children, 321-323.
 œdema, acute, 315-316.
 of epiglottitis, 313.
 subglottic, 318, 319.
 pathology, 310-311.
 "rugæ" of inter-arytenoid space, 316.
 symptoms, 311-323.
 treatment, 323-327.
 catarrhal, 305-327.
 chronic, 457-499.
 classification, 457-459.
 course, 483-486.
 diagnosis, 481-483.
 etiology, 459-467.
 formulæ of medicaments, 495-499.
 hyperæmia, 469, 470.
 hyperplastic form, 470, 471.
 hypertrophic form, 472, 473.
 laryngoscopic appearances, 469-475.
 cedematous form, 471, 472.
 pachydermia laryngis, 473.
 pathology, 475-479.
 symptomatology, 467-469.
 termination, 483-486.
 traumatic, 479-481.

- Laryngitis**, chronic, treatment, 486-499.
 climatic, 487, 488.
 electrical, 488.
 hygienic, 487.
 medicinal, 486, 487.
 special forms, 491-495.
 topical, 489-491.
hæmorrhagica, 474, 475.
hypertrophica chronica inferior, 473.
leprous, 435-456.
 definition, 435.
 diagnosis, 450-452.
 duration, 447.
 etiology, 436-441.
 frequency, 435, 436.
 march, 447.
 pathology, 447-450.
 prognosis, 452.
 symptoms, 441-447.
 termination, 447.
 treatment, 452-456.
lupous, 412-435.
 definition, 412.
 diagnosis, 424-428.
 duration, 423.
 etiology, 414-417.
 frequency, 413, 414.
 pathology, 424.
 prognosis, 428.
 symptoms, 417-423.
 treatment, 428-435.
 tubercule, 430, 431.
simple, 305-327.
spasmodic, 334-336.
syphilitic, 813-825.
Laryngo-pharynx, 195.
Larynx, acute catarrh of, 305-327.
 anatomy, 198-209.
 anterior commissure, 204.
 arteries, 207, 208.
 ary-epiglottic fold, 203.
 arytenoid muscle, 206.
 chink of the glottis, 204.
 crico-arytenoid articulation, 202.
 ligament, 202.
 crico-thyroid membrane (median ligament), 202.
 epiglottis, crest of, 203.
 cushion of, 203.
 glands, 207.
 glosso-epiglottic ligament, median, 202.
 glottic division of larynx, 204.
 hyo-epiglottic ligament, 201.
 inferior thyro-arytenoid ligaments, 203, 204.
 infra-glottic division of larynx, 204.
 inter-arytenoid space, 204.
 lateral, thyro-hyoid ligaments, 201.
 lymphatics, 208, 209.
 median ligament, 201.
 mucous membrane, 206, 207.
 muscles, 205-206.
 nerves, 208.
 posterior commissure, 204.
 rima glottidis, 204.
 sacculus laryngis, 203.
 sesamoid cartilages, anterior, 201.
 supra-glottic division of larynx, 204.
 thyro-arytenoid ligaments, 203.
 thyro-epiglottic ligament, 202.
 thyro-hyoid ligament, 201.
 membrane, 201.
 veins, 208.
 ventricles of larynx, 203.
 of Morgagni, 203.
 ventricular bands, 203.
 vocal cords, false, 203.
Larynx, anatomy, vocal cords, true, 203, 204.
 anterior commissure, 204.
 arytenoid cartilages, 200.
 cartilages of Santorini, 199, 201, 203.
 of Wrisberg, 199, 201, 203.
 cavity, 203-207.
 cornicula laryngis, 201.
 cricoid cartilage, 200.
 crico-tracheal ligament, 202.
 epiglottis, 200, 201.
 female, 218.
 foreign bodies in, 500-533.
 bronchial septum, 509.
 diagnosis, 514-516.
 expulsion, spontaneous, 519, 520.
 modes of entrance, 503-507.
 physical conditions attending lodgement, 507-511.
 prognosis, 516-519.
 spontaneous migration, 519, 520.
 symptoms, 511-514.
 treatment, 520-532.
 bronchotomy, 526, 532.
 crico-thyroid laryngotomy, 526.
 expulsion through natural passages, 520, 522.
 extraction through artificial channels, 526-532.
 through natural passages, 522-526.
 laryngotomy, 527.
 laryngo-tracheotomy, 527.
 pharyngotomy, 527.
 thyroidotomy, 526.
 thyrotomy, 526.
 tracheotomy, 527.
 varieties, 501-503.
 framework, 199.
 glands, 207.
 glottic division, 204.
 hyoid bone, 199.
 in fevers, 622-663.
 infra-glottic division, 204.
 in phonation, 209-211.
 in respiration, 209.
 in singing, 211.
 in speech, 211.
 inter-arytenoid space, 204.
 intubation of, 390-396.
 lymphatics, 208, 209.
 male, 218.
 malformations, congenital, 734-743.
 dilatations, 737, 768.
 growths, 738-743.
 hypertrophies, 738-743.
 papilloma, 739-743.
 pouches, 737, 738.
 stenosis, 734-737.
 malformations, non-congenital, 743-751.
 eversion of ventricle, 750, 751.
 stenosis, 743-750.
 leprous, 750.
 lupous, 747-750.
 syphilitic, 744-747, 825.
 traumatic, 743, 744.
 tubercular, 747.
 malignant growths, 767-781.
 epitheliomata, 773-778.
 etiology, 767-772.
 sarcomata, 778-781.
 syphilis as a cause, 771.
 treatment, 781-791.
 mucous membrane, 206, 207.
 muscles, 205, 206, 220-225.
 aryteno-epiglottic, "ary-epiglottic," 206.

Larynx, muscles, arytenoid, solitary, 206.
 crico-thyroid, 205.
 lateral crico-arytenoid, 205.
 posterior crico-thyroid, 205.
 superior thyro-arytenoid, 206.
 thyro-arytenoids (true vocal muscles), 205.
 thyro-epiglottic, 206.
neoplasms of, 751-781.
 adenomata, 758, 759.
 angiomata, 759-761.
 cystomata, 759.
 enchondromata, 761, 762.
 fibro-cellular growths, 757, 758.
 fibromata, 756, 757.
 innocent neoplasms, 751-767.
 lipomata, 761.
 mucoceles, 759.
 mucous polypi, 757, 758.
 myxomata, 757, 758.
 papillomata, 752-756.
 treatment, 762-767.
nerves, 208.
neuroses of, 669-699.
 adductor paralysis, 692, 693.
 anæsthesia, 671, 672.
 bilateral paralysis of the abductors, 688, 691.
 from nasal disease, 114, 115.
 hyperæsthesia, 670, 671.
 laryngeal chorea, 678-683.
 paralysis, 683-694.
 vertigo, 678-683.
 paræsthesia, 672-674.
 paralysis of internal tensors,—thyro-arytenoidei, 693, 694.
 reflex uterine neuroses, 694-698.
 spasm of glottis in adults, 677, 678.
 in children, 674-677.
 unilateral abductor paralysis, 689, 690, 691, 692.
physiology, 209-211.
 intensity of voice, 210.
 phonation, 209-211.
 pitch of voice, 210.
 quality, or timbre, 210.
 respiration, 209.
 singing, 211.
 speech, 211.
 tension of vocal cords, 210.
 timbre of voice, 210.
pomum Adami, 198, 199.
posterior commissure, 204.
 reflex nasal irritation of, 114, 115.
 ring cartilage, 200.
 sesamoid cartilages, posterior, 201.
 supra-glottic division, 204.
 syphilis of, 813-825.
 thyroid cartilage, 199.
 tuberculosis of, 792-812.
 acute tuberculosis, 793.
 bacilli, 792.
 chondritis, 802.
 condylomatous infiltration, meso-arytenoid, 801.
 diagnosis, 805, 806.
 etiology, 803.
 infiltration of epiglottis, 799.
 irregular vascularities, 798, 799.
 local suppuration, 798.
 microscopic inspection of tuberculous infiltration, 800, 801.
 microscopic inspection of ulcerations, 797, 798.
 miliary tubercle, 794.
 pathology, 792.
 perichondritis, 802.

Larynx, tuberculosis of, polypoid excrescences, 802.
 prognosis, 806-808.
 secondary tuberculosis, 794.
 symptomatology, 803-805.
 treatment, 809-812.
 tuberculous infiltration of larynx, 800.
 ulceration, 796.
 of epiglottis, 793.
 of vocal bands, 801.
 veins, 208.
 ventricles, 203.
 vocal bands, 203, 204.
 processes, 200.
Leber's disease, 153.
Leprosy of the larynx, 435-456.
 tubercule in, 453.
 of the nose, 180, 181.
Leprous stenosis of larynx, 750.
Lincoln, Rufus P., M.D., on the pharynx and larynx in the exanthemata and other febrile affections, 622-669.
Lipomata of larynx, 761.
Lupous stenosis of larynx, 747-750.
Lupus of the larynx, 412-435.
 tubercule in, 430, 431.
 of the nasal cavities, 24-26.
 of the nose, 181-184.
Luschka, tonsil of, 195.

M.

MacCoy, Alexander W., M.D., on anatomy and physiology of the pharynx and larynx, 192-211.
Malignant growths of larynx, 767-781.
 neoplasms, nasal cavities, 19, 20.
Median ligament, larynx, 201.
Mental diseases from nasal disease, 136.
Migraine from nasal disease, 131-133.
 reflex nasal, 131-133.
Morgagni, ventricles of, 203.
Mouth, reflex nasal irritation, 112-114.
Mucocele of larynx, 759.
Muscles, constrictor, of pharynx, 195, 196.
Music, history of, 212, 213.
 "Musical ear," 214.
 tones, production by larynx, 225, 239.
Myxomata, larynx, 757, 758.
 nasal, 58.

N.

Nævus of the nose, 184.
Nancrede, Charles B., M.D., on the surgical treatment of croup and diphtheria, 390-411.
Nasal atresia, congenital, 65.
 caries, surgical procedure, 64.
 cautery, effect on nasal duct, 164.
 cavities, morbid growths, 1-37.
 adenoma, 13.
 angioma, 16.
 bony occlusion, 31, 38.
 chondromata, 16-18.
 cystic polypi, 14.
 deformities, 37, 38.
 deviation of septum, 37.
 echondrosis, 29, 30.
 erectile tissue, 5, 6.
 tumors, 15, 16.
 etiology of morbid growths, 4-8.
 exostosis, 31, 32.
 fibroids, 12, 13.
 foreign bodies, 32-35.
 gummata, 21-23.
 history of tumors, 2-4.

- Nasal cavities, morbid growths, hyperplasias, 26-29.
 hypertrophies, 27-29.
 lupus, 24-26.
 malignant neoplasms, 19, 20.
 mucous polypi, 9-12.
 necrosed bone, 36.
 nerve-supply, 8.
 osteomata, 18, 19.
 papillomata, 14, 15.
 physiology, 6-8.
 polypi, 8-14.
 polypoid excrescences, 9.
 rhinoliths, 35-37.
 secretion, 7.
 sense of smell, 8.
 soft papilloma, 14.
 split septum, 38.
 synechia, 30, 31.
 syphilis, 20-23.
 tuberculosis, 23, 24.
 disease caused by disease of the eye, 171-173.
 cold in head from ametropia, 171.
 nose-bleed from ametropia, 171.
 ozena, relation to epiphora, 172.
 in hay-fever, 70-73.
 reflex, from ocular maladies, 149-172.
 duct, effect of unskilful use of cautery in, 164.
 reflex neuroses, 97-148.
- Necrosed bone, nasal cavities, 36.
- Neoplasms, innocent, of larynx, 751-767.
 nasal, benign, 58-63.
 malignant, 63, 64.
 myxomata, 58.
 surgery of, 58-64.
- Nervous cough, 109-112.
- Neuralgia, reflex nasal, 131-133.
 supra-orbital, from nasal disease, 155.
- Neurasthenia, in nasal disease, 140-142.
- Neuritis, retro-bulbar, from nasal disease, 156.
- Neuroses, nasal reflex, historical, 101.
 of larynx, 669-699.
 of nose, aprosexia, 135, 136.
 asthma, 102.
 chorea, 133-135.
 cough, 109-112.
 diagnosis, 144.
 epilepsy, 135, 136.
 etiology, general, 142.
 eye-disease, 128-131.
 headache, 131-133.
 heart-disease, 137.
 hyperæsthesia, 107, 108.
 hysteria in, 140-142.
 Graves's disease in, 137, 138.
 mental diseases, 136.
 migraine, 131-133.
 neuralgia, 131-133.
 neurasthenia, 140-142.
 prognosis, 144, 145.
 reflexes in the ear, 128.
 in the eye, 128-131.
 outside the respiratory tract, 127.
 respiratory, 106-125.
 sexual organs, 140.
 skin-diseases of nose and face, 138-140.
 sternutation, 108, 109.
 stomach, 136.
 tic douloureux, 131-133.
 treatment, 145-148.
 vertigo, 135, 136.
- of nose and naso-pharynx, 90-148.
 asthma, 127.
- Neuroses of nose and naso-pharynx, olfaction, 90-97.
 reflex, 97-148.
 of olfaction, 90-97.
 anosmia, 92-97.
 diagnosis, 95.
 prognosis, 94.
 symptoms, 94.
 treatment, 95-97.
 anosmia essentialis, 92.
 intra-cranialis, 93.
 anosphresia, 92-97.
 hyperosmia, 91.
 hyperosphresia, 91.
 parosmia, 90, 91.
 parosphresia, 90, 91.
 reflex nasal, 97-148.
 asthenopia, 129.
 asthma, 115-127.
 chorea, 133-135.
 classification, 106.
 diagnosis, 144.
 epilepsy, 135, 136.
 etiology, 142-144.
 Graves's disease, 137, 138.
 headaches, 131-133.
 heart, 137.
 historical, 101-106.
 hysteria, 140-142.
 lachrymation, 128.
 laryngismus stridulus, 114.
 larynx, 114, 115.
 migraine, 131-133.
 mouth, 112-114.
 neuralgia, 131-133.
 neurasthenia, 140-142.
 œdema of eyelids, 128.
 pharynx, 112-114.
 physiology, 97-101.
 prognosis, 144.
 respiratory, 106, 107.
 sexual organs, 140.
 skin-diseases of face, 138, 139.
 of nose, 138, 139.
 sternutation, 108, 109.
 stomach, 136, 137.
 tic douloureux, 131-133.
 treatment, 145-148.
- Neurotic habit in hay-fever, 70.
- Nose, congenital or developmental anomalies of the, or of adjacent structures, affecting the eye, 152-154.
 fracture of, surgical procedure, 65.
 hæmatoma of, 65.
 pathological conditions of the, secondarily affecting the eye, 152.
 skin-diseases of, 173-191.
 acne, 173-175.
 eczema, 175-177.
 epithelioma, 177-179.
 eruptions from bromide and iodide of potassium, 191.
 erysipelas, 179, 180.
 erythema, 180.
 leprosy, 180, 181.
 lupus, 181-184.
 nævus, 184.
 nasal reflex, 138, 139.
 psoriasis, 184.
 rhino-scleroma, 185.
 rosacea, 185, 186.
 seborrhœa, 187.
 sycoosis, 187.
 syphilis, 187-191.
 telangiectasis, 191.
 surgery of, 39-65.
- Nose-bleed caused by ametropia, 171.

O.

- Occlusion, bony, nasal cavities, 31, 38.
 Oedema of eyelids, reflex nasal, 128.
 Oesophagismus, 113.
 Oesophagus, foreign bodies in, 533-570.
 extraction, 562-570.
 incision, 566-570.
 propulsion, 564-566.
 Olfaction, neuroses of, 90-97.
 Ophthalmia, gonorrhoeal, conveyed from the nose, 158, 159.
 neonatorum conveyed from the nose, 158.
 Optic atrophy, congenital, from nasal disease, 153.
 from nasal disease, 158.
 disk, atrophy of, from ethmoidal and sphenoidal sinuses, 154.
 nerve, compression of, from tumors of sphenoidal and ethmoidal sinuses, 157.
 Orbital abscess from coryza, 156.
 from empyema of antrum of Highmore, 155.
 Oro-pharynx, 192.
 Os planum, necrosis of, in nasal disease, 155.
 Osteomata, nasal cavities, 18, 19.
 Ozæna cause of eye-diseases, 159.
 corneal ulceration from, 161.
 epiphora from, 163, 164.
 relation to epiphora, 172.

P.

- Pachydermia laryngis, 473.
 Palate, hard, 192, 193.
 soft, 193.
 muscles of, 193.
 Pannus with disease of lower turbinates, 160.
 Panophthalmitis from empyema of antrum of Highmore, 155.
 Papillitis from ozæna, 159.
 Papilloma, soft, nasal cavities, 14.
 Papillomata, larynx, 752-756.
 nasal cavities, 14, 15.
 Paræsthesia of larynx, 672-674.
 Parosmia, 90, 91.
 Parosphresia, 90, 91.
 Pathology of hay-fever, 73-75.
 Perichondritis laryngis, 482.
 chronica, 473.
 Peritonsillar abscess, 260-265.
 Peritonsillitis, 260-265.
 Pharyngitis abscedens, 260-265.
 Pharyngitis, acute catarrhal, 250-259.
 etiology, 250, 257.
 pathological anatomy, 254.
 prophylaxis, 228, 259.
 symptoms, 251-254.
 synonymes, 250.
 treatment, 254-258.
 catarrhal, subacute, 259, 260.
 chronic, 284-304.
 follicular, 284-291.
 diagnosis, 287, 288.
 etiology, 285.
 prognosis, 288.
 retro-pharyngeal abscess in, 301.
 symptoms, 286, 287.
 treatment, 288, 291.
 erysipelatos, 268.
 gangrenous, 268.
 herpetica, 270, 271.
 phlegmonous, 260-265.
 acute infectious, 265, 266.
 rheumatic, 272.
 syphilitic, 292-298.
 Pharyngitis, tubercular, 298-301.
 ulcerosa, 266-268.
 Pharyngo-laryngeal sinus, 195.
 Pharynx, acute inflammation of, 250-259.
 anatomy and physiology of, 192-211.
 arteries, 196.
 azygos uvulæ, 193.
 constrictor muscles, 195, 196.
 epiglottis, 195.
 fauces, 192.
 hard palate, 192, 193.
 isthmus of fauces, 192.
 laryngo-pharynx, 195.
 lymphatics, 197.
 motor nerves, 197.
 mucous membrane, 196.
 oro-pharynx, 192.
 pharyngo-laryngeal sinus, 195.
 plica salpingo-pharyngea, 193, 194.
 pyramidal sinus, 195.
 sensory nerves, 197.
 soft palate, 193.
 muscles, 193.
 tonsil of Luschka, 195.
 tonsils, 194, 195.
 uvula, 193.
 veins, 196, 197.
 velum, 193.
 Deformities, 709-719.
 pouches, 717-719.
 stenosis, congenital, 710, 711.
 secondary, 711, 717.
 Effects of nasal disease on, 112.
 Erysipelas of, 268.
 Foreign bodies in, 533-570.
 diagnosis, 551-555.
 etiology, 533-539.
 migration, 544, 545.
 prognosis, 555, 556.
 resultant diseased conditions, 545-551.
 abscess, 545, 546.
 caries of vertebrae, 549, 550.
 oedema of larynx, 545.
 penetration of pericardium and heart, 549.
 penetration of pleural cavity, lungs, and bronchi, 549.
 perforation of blood-vessels, 547-549.
 rupture of œsophagus, 550, 551.
 stricture, 546.
 ulceration, 546.
 Symptoms, 539-543.
 imaginary, 542, 543.
 immediate, 539-541.
 remote, 541, 542.
 tolerance, 543, 544.
 treatment, 556-562.
 Herpes of, 270, 271.
 Malignant disease, 295.
 Morbid growths, 719-734.
 innocent growths, 720-727.
 angiomata, 722, 723.
 cysts, 726.
 fibroma, 721.
 lipomata, 721, 722.
 lymphadenomata, 720, 721.
 lymphoma, 720, 721.
 myxomata, 721.
 papillomata, 724-726.
 teratomata, 726.
 malignant growths, 727-734.
 epitheliomata (carcinomata), 731-734.
 lympho-sarcomata, 730, 731.

Pharynx, malignant growths, myxo-sarcomata, 729, 830.
 sarcoma, round-cell, 727, 728.
 spindle-cell, 728, 729.
 sarcomata, 727-731.
 primary growths, 719.
 neuroses of, 699-704.
 motion, 700-704.
 sensation, 699, 700.
 physiology of, 197-211.
 deglutition, 197-198.
 reflex nasal irritation of, 112-114.
Pharynx and larynx in fevers, 622-668.
 acute glanders, 668.
 gout, 667.
 rheumatism, 665-667.
 cerebro-spinal fever, 661.
 dengue, 663.
 erysipelas, 643-650.
 infectious anginas, 650-653.
 influenza, 663-665.
 malarial fever, 662.
 measles, 638-641.
 mumps, 642, 643.
 relapsing fever, 660, 661.
 rötheln, 641, 642.
 scarlatina, 622-633.
 typhoid fever, 653-658.
 typho-malarial fever, 662.
 typhus fever, 658-660.
 varicella, 638.
 variola, 633-637.
 varioid, 637.
 yellow fever, 661.
Phlyctenular disease from rhinitis, 160.
Phonation, 225-239.
Photophobia from swollen turbinates, 169.
Pitch of voice, 216.
Plica salpingo-pharyngea, 193, 194.
Pollen as cause of hay-fever, 68, 69.
Polypi, cystic, nasal cavities, 14.
 mucous, of larynx, 757, 758.
 nasal, 9-12.
 nasal cavities, 8-14.
Polypoid excrescences, nasal cavities, 9.
Porcher, W. Peyre, M.D., on neuroses of the larynx and of the pharynx, and dysphagia, 669-709.
Presbyopia, from nasal disease, 153.
Pre-tracheal space, surgical anatomy, 396-399.
Psoriasis of the nose, 184.
Psychic influence in hay-fever, 72.
Pyramidal sinus, larynx, 195.

Q.

Quality of voice, 216.
Quinsy, 260-265.

R.

Raucedo syphilitica, 815.
Resonators, natural, of voice, 235-237.
Respiration, 209.
Respiratory reflex neuroses, 106, 107.
Retina, congestion of, from nasal disease, 169.
Rheumatic sore throat, 272.
Rhigolene in nasal surgery, 40.
Rhinoliths, 35-37.
Rhino-scleroma, 185.
Rhinoscope and tongue-depressor (Jarvis's), 44, 45.
Rima glottidis, 204.
Ring cartilage, 200.

Roe, John O., M.D., on foreign bodies in the larynx and trachea, and in the pharynx and oesophagus, 500-570.
Rongeur septum-forceps (Jarvis's), 52.
Rosacea of the nose, 185, 186.

S.

Sacculus laryngis, dislocation, 750, 751.
Santorini, cartilages of, 199, 201, 203.
Sarcomata of larynx, 778-781.
 lympho-, of pharynx, 730, 731.
 myxo-, of pharynx, 729, 730.
 of pharynx, 727-731.
 round-cell, of pharynx, 727, 728.
 spindle-cell, 728, 729.
Saw in nasal deformities, 48.
Scarlatina, larynx and pharynx in, 622-633.
Scissor-punch (Jarvis's) in nasal surgery, 52.
Seborrhœa of the nose, 187.
Secretion, nasal cavities, 7.
Seiler, Carl, M.D., on morbid growths and deformities of the nasal cavities; pathology, etiology, physiology, and differential diagnosis, 1-38.
Septometer (Jarvis's) in nasal surgery, 50.
Septum, deviation, nasal cavities, 37.
 nasal, surgery of deformities, 47-58.
 perforation, 65.
 scissor punch (Jarvis's), 52.
 split, nasal cavities, 38.
Sesamoid cartilages, 201.
Sexual organs affected in nasal diseases, 140.
 reflex nasal irritation, 140.
Shurly, E. L., M.D., on chronic laryngitis, simple and traumatic, 457-499.
Singing, larynx in, 211.
Skin-diseases of nose and face, reflex from nasal disease, 138-140.
Smell, sense of, 8.
Smith, J. Lewis, M.D., on diphtheria, 343-390.
Snare, Jarvis's, in nasal hypertrophy, 44.
Sneezing, morbid, 108, 109.
 nasal reflex, 108, 109.
Sore throat, acute, 250-259.
 aphthous, 270, 271.
 clergyman's, 284-292.
 common membranous, 270, 271.
 gouty, 273.
 granular, 284-292.
 hospital, 284-292.
 rheumatic, 272.
 ulcerated, 266-268.
Spasmodic croup, 334-336.
Speech, larynx in, 211.
Sphenoidal sinuses, disease of, effect on eye, 154.
Spheno-palatine ganglion, 8.
Stammering, 247, 248.
Stellate punch in deformities of septum, 57.
Stenosis, membranous, of larynx, 486.
 traumatic, of larynx, 743, 744.
Sternutation, nasal reflex, 108, 109.
Stomach, diseases of, from nasal disease, 137.
 reflex nasal irritation, 136, 137.
Strabismus from nasal disease, 153.
Stuttering, 247, 248.
Surgery of nose, 39-65.
 abscess, 65.
 adenoids, 61.
 angiomata, 61, 62.
 antisepsis, 39-41.
 asymmetry of bones, 65.
 benign neoplasms, 58-63.
 cocaine, 40.
 congenital nasal atresia, 65.
 deformities of septum, 47-58.

Surgery of nose, éraseur for adenoids, 61, 62.
 fracture of nose, 65.
 general anæsthetics, 40.
 hæmatoma, 40.
 hemorrhage, 40.
 hypertrophy of turbinated tissue, 41-47.
 chemical caustics, 41.
 electric cautery, 42.
 excision methods, 43-47.
 Jarvis's snare, 44.
 nasal éraseur, 44.
 posterior hypertrophies, 45.
 rhinoscope and tape-holders, 45.
 transfixion-needles, 45, 47.
 local anæsthesia, 40.
 malignant neoplasms, 63, 64.
 miscellaneous conditions, 64, 65.
 neoplasms, 58-64.
 rhigolene, 40.
 septum-deformities, 50-58.
 éraseur, 50, 51.
 forceps, 51-53.
 hæmostatic clamp (Jarvis's), 51.
 knife, 48.
 nasal clamp-splint, 57.
 perforation, 65.
 rongeur septum-forceps (Jarvis's), 52.
 saw, 48.
 scissor-punch, 52.
 septometer (Jarvis's), 50.
 stellate punch procedure, 57.
 surgical drill in nasal deformities, 53-56.
Sycosis of the nose, 187.
Synechise, nasal cavities, 30, 31.
Syphilis as cause of malignant disease in larynx, 771.
 nasal cavities, 20-23.
 of the larynx, 813-825.
 of the nose, 187-191.
Syphilitic pharyngitis, 292-298.
 diagnosis, 293, 294.
 prognosis, 295.
 symptoms, 293.
 treatment, 296-298.
stenosis of larynx, 744-747.

T.

Telangiectasis of the nose, 191.
Temporal neuralgia from nasal disease, 156.
Thorner, Max, A.M., M.D., on acute pharyngitis, 250-274.
Thyro-arytenoid ligaments, 203.
Thyro-epiglottic ligament, 202.
Thyro-hyoid ligament, 201.
 ligaments, lateral, 201.
 membrane, 201.
Thyroid cartilage, 199.
Tic douloureux, 131-133.
 reflex nasal, 131-133.
Tonsil, benign tumors, 610-613.
 calculi, 598.
 chronic abscess of, 595, 596.
 foreign bodies in, 598, 599.
 lupus, 607-610.
 malignant disease, 613-621.
 mycosis of, 596-598.
 of Luschka, 195.
 syphilis, 600-603.
 tuberculosis, 603-607.
Tonsillitis, acute, 274-284.
 diagnosis, 279, 280.

Tonsillitis, etiology, 274, 275.
 pathology, 278, 279.
 prognosis, 280, 281.
 symptoms, 276-278.
 treatment, 281-283.
Tonsils, 194, 195.
 adherent, 574.
 chronic inflammation, 571-595.
 adenoids in vault of pharynx, 578.
 aural disturbance from, 576, 577.
 lymphatism, 578.
 respiratory neuroses from, 576.
 treatment, surgical, 580-595.
 anæsthetics, 593-595.
 cold-wire snare, 582.
 cutting operations, 586-595.
 "electro-cautery dissection," 581, 582.
 electrolysis, 579.
 enucleation, 582.
 galvano-cautery, 581.
 hemorrhage from cutting, 586-591.
 ignipuncture, 581.
 Knight's electric snare, 584, 585.
 tonsil compressor, 590.
 tonsillotomy, Mackenzie's, 592.
 Wright's electric amygdalotome, 584.
 clinical groups of disease, 574-576.
 enlarged, effects on health, 577-579.
 treatment, 579-595.
 flat, 574.
 hypertrophied, 571-595.
 lacunæ of, 194.
 large, 573.
 parasites in, 599, 600.
 phonatory disturbances in disease, 576, 577.
 varieties of inflammation, 571-574.
Trachea, foreign bodies in, 500-533.
Tracheotomy, 396-401.
 after-treatment, 406-408.
 causes of death, 410.
 cellulitis, 405.
 choice of operation, 401.
 complications affecting wound, 409.
 diphtheritic infection of the wound, 405.
 emphysema, 405.
 feeding patients, 409, 410.
 high operation, 401-403.
 laryngo-tracheotomy, 403.
 low operation, 403, 404.
 rapid, 406.
 removal of canula, 408, 409.
 secondary hemorrhage, 405.
 value of, 410, 411.
 without a tube, 405.
Trachoma from nasal disease, 160.
 from ozæna, 159.
 of vocal cords, 473.
Transfixion-needles, nasal hypertrophies, 45, 47.
Traumatic laryngitis, 479-481.
Tubercle, miliary, of larynx, 794.
Tubercular infiltration of epiglottis, 799.
 stenosis of larynx, 747.
 ulceration of larynx, 796.
Tuberculin in leprosy of larynx, 453.
 in lupus of larynx, 430, 431.
Tuberculocidin in tuberculosis, 810.
Tuberculosis, acute, of larynx, 793.
 nasal cavities, 23, 24.
 of larynx, 792-812.
Tuberculous chondritis of larynx, 802.
 infiltration of larynx, 800.

Tuberculous meso-arytenoid infiltration, 801.
 perichondritis of larynx, 802.
 polypoid excrescences in larynx, 802.
 ulceration of vocal bands, 801.
Tumors of nasal cavities, history, 2-4.

U.

Uterine reflex neuroses of larynx, 694-698.
Uvula, 193.
 club-shaped, in tuberculosis, 805.
Uvulæ, azygos, 193.
Uvulitis, 260.

V.

Variola, pharynx and larynx in, 633-637.
Velum palati, 193.
Ventricles of Morgagni, 203.
Ventricular bands, larynx, 203.
Vertigo from nasal disease, 135-136.
 laryngeal, 678-683.
 reflex nasal, 135, 136.
Visual field, limitations of, from nasal disease, 157.
 narrowing of, from nasal disease, 155, 156.
Vocal bands, true, 203, 204.
 cords, false, 203.
 in phonation, 220-234.
 nerve-supply, 219.
 tension of, 210.
 trachoma of, 473.
 true, 203, 204.
 culture and hygiene, 212-247.
 chest-capacity, 238, 239.
 correction of vocal defects, 247-249.
 essentials of vocal culture, 214-217.
 female larynx, 218.
 history of music, 212, 213.
 hygiene of voice, 241, 247.

Vocal culture and hygiene, male larynx, 218.
 mouth, training of, 239, 240.
 muscles of larynx, 220-225.
 musical ear, 214.
 nerve-supply of vocal cords, 219.
 palate as resonator, 240, 241.
 phonation, 225-239.
 physiology of voice, 217-241.
 pitch, 216.
 production of musical tones, 225-239.
 quality, 216.
 resonators, mouth and palate, 235-237.
 rules for development of voice, 237-241.
 stammering, 247, 248.
 stuttering, 247, 248.
 vocal cords in phonation, 220-234.
 defects and their correction, 247-249.
 voice-cultivation, 214.
 voice in speaking, 243-247.
 defects and their correction, 247-249.
 processes, 200.
Voice, hygiene, 241-243.
 intensity, 210.
 in speaking, 243-247.
 physiology, 217-241.
 pitch of voice, 210.
 quality, 210.
 rules for developing, 237-241.
 singing, 211.
 timbre, 210.

W.

White, Joseph A., A.M., M.D., on neuroses of the nose and naso-pharynx, 90-148.
Wright's electric amygdalotome, 584.
Wrisberg, cartilages of, 199, 201, 203.

GENERAL INDEX.

A.

Abscess, cerebral, chronic purulent otitis media, i.
 451.
 encysted, i. 454, 455.
 of auricle, i. 151.
 of brain, chronic purulent otitis media, i.
 456, 458.
 of nose, ii. 65.
 retro-pharyngeal, ii. 301.
Accessory cavities of the nose, differential diag-
nosis between the diseases of, i.
 774, 775.
 diseases of, i. 743-775.
Acne of nose, ii. 173-175.
Acoumeter, i. 94.
Acute catarrhal otitis media, i. 273-294.
 adenoids in treatment, i. 283-
 288.
 appearances of membrana tym-
 pani, i. 288, 289.
 cases, i. 277-281, 305, 306-322.
 causation, i. 274, 275.
 cupping-glass, i. 291.
 Heurteloup's artificial leech, i.
 291.
 leeches, i. 290.
 local bleeding, i. 291.
 naso-pharynx in, i. 282-288.
 paracentesis membranæ tym-
 pani, i. 293, 294.
 preventive hygiene, i. 322.
 relief of pain, i. 293.
 symptoms, i. 275, 277, 302-
 304.
 treatment, i. 290-294.
 vapors in, i. 299.
Acute otitis externa, i. 166-215.
Acute purulent otitis media, i. 304-322.
 course and complications, i.
 304-314.
 diagnosis, i. 314-318.
 etiology, i. 300, 301.
 grippe as a cause, i. 313, 314.
 influenza as a cause, i. 313, 314.
 malignant disease mistaken
 for, i. 315-318.
 membrana tympani, appear-
 ance of, i. 301, 302.
 prognosis, i. 318, 319.
 treatment, i. 319-322.
"Adam's apple," ii. 198, 199.
Adductor tubæ, i. 65.
Adenoid hypertrophy of vault of pharynx, atro-
phic stage, i. 654.
 chronic rhinitis, i. 648.
 ear-complications, i. 649.
 physical examination, i. 650.
 symptoms, i. 649.
 treatment, i. 651-655.
Adenoids in naso-pharynx, i. 289.

Adenoids in naso-pharynx, acute catarrh of mid-
dle ear, i. 282-288.
 Blake on, i. 286, 287.
 Hooper on, i. 284, 285.
 Meyer on, i. 282-284.
 nasal, ii. 61.
Adenoma, petrous bone, i. 464.
Adenomata, larynx, ii. 758, 759.
 nasal cavities, ii. 13.
 treatment, i. 644.
Age, in hay-fever, ii. 72.
Alkaline sprays, local therapeutics, i. 596, 597.
Amblyopia caused by galvano-cautery in nose, ii.
169.
 from nasal disease, ii. 155.
Ametropia cause of "common cold," ii. 171.
 cause of nose-bleed, ii. 171.
Ampullæ, i. 23.
Ampullæ, physiology, i. 90.
Anæsthesia, local, in nasal surgery, ii. 40.
 of larynx, ii. 671, 672.
Anæsthetics, general, in nasal surgery, ii. 40.
Andersch, ganglion of, i. 81.
Aneurism of basilar arteries, effect on ear, i. 554.
Angina arthritica, ii. 273.
 catarrhalis acuta, ii. 250-259.
 croupous (benign), ii. 270, 271.
 nosocomii, ii. 266-268.
 rheumatic, ii. 272.
 ulcerosa, ii. 266-268.
Angioma, auricle, i. 159, 160.
 cavernous, nasal, ii. 62.
 nasal cavities, ii. 16.
Angiomata, nasal, ii. 61, 62.
 of larynx, ii. 759-761.
Annulus tympanicus, i. 15, 28.
 attachment, i. 27.
Anomalies of antihelix, i. 123.
 of antitragus, i. 126.
 of helix of ear, i. 123.
 of lobule of ear, i. 126.
 of tragus, i. 126.
Anosmia, ii. 92-97.
Antihelix, anomalies of, i. 123.
 of auricle, i. 33.
Antisepsis of the nose, ii. 39-41.
Antiseptic sprays, i. 596.
Antitragus, i. 33.
 anomalies of, i. 126.
Antroscope, i. 755.
Antrum, carcinoma of, i. 757.
 cysts of, i. 756, 757.
 diphtheria of, i. 755.
 drill (Cohen's), i. 753.
 mastoideum, i. 5.
 phlegmonous inflammation of, i. 755.
 tuberculosis of, i. 756.
 tumors of, i. 756.
Apthous sore throat, ii. 270, 271.
Aponeurosis, deep cranial, i. 35.
Aprosexia from nasal disease, ii. 135, 136.

- Aprosexia**, reflex nasal, ii. 135, 136.
- Aqueductus cochleæ**, petrous bone, i. 13.
vestibuli, i. 11.
- Aqueduct of Fallopius**, i. 11, 16.
- Area cribrosa media**, i. 11.
superior, i. 11.
- Arnold**, Jacob D., A.M., M.D., on acute laryngitis, ii. 305-327.
- Arnold's nerve**, i. 11, 42, 81.
- "Ary-epiglottic" fold**, ii. 203.
- Aryteno-epiglottic fold**, ii. 203.
- Arytenoid cartilages**, ii. 200.
muscle, ii. 206.
- Aspergilli**, i. 195, 196.
in the ear, i. 194-196.
- Aspiration of tympanic cavity**, i. 299.
- Asthenopia from nasal disease**, ii. 153, 156.
from swollen turbinates, ii. 169.
psychic, from nasal disease, ii. 156.
reflex nasal, ii. 129.
- Asthma**, ii. 129.
from nasal disease, ii. 115-126.
from neuroses of nose, ii. 102.
reflex nasal, ii. 115-127.
- Astigmatism from nasal disease**, ii. 153.
- Asymmetry of nasal bones**, surgery of, ii. 65.
- Atheroma of auricle**, i. 153, 159.
- Atresia**, nasal, congenital, ii. 65.
- Atrium**, chronic suppuration of, i. 413-434.
- Atrophy of conjunctiva from atrophic rhinitis**, ii. 160.
- Attic**, cases of excision of membrana and ossicula, i. 438-444.
chronic suppuration of, i. 434-444.
(cupola) measurements of, i. 54.
treatment of chronic suppuration, i. 436-444.
- Attollens aurem**, i. 35.
- Audition**, acuteness of, i. 89.
biaural, i. 84.
monaural, i. 84.
- Auditory canal**, acute inflammation, i. 166-215.
anatomy, i. 36-42.
annular sequestrum of, i. 450, 451.
appearances in chronic purulent otitis media, i. 412.
bony growths in, i. 232-247.
chronic inflammation, i. 215-217.
exostosis, i. 232, 233.
external, exostoses in chronic purulent otitis media, i. 444.
external meatus, i. 9.
foreign bodies in, i. 218-229.
hyperostosis, i. 233-238.
malignant disease, i. 215-217.
neoplastic closure, i. 247-252.
narrowing, i. 247-252.
- meatus**, canal of Huguier, i. 10.
external auditory process, i. 10.
osseous, i. 8.
fissure of Glaser, i. 10.
foramen of Huschke, i. 10.
Glaserian fissure, i. 10.
tympanic plate, i. 10.
vaginal process, i. 10.
- nerve**, i. 77, 78.
peripheral course, i. 78.
terminations of, in cochlea, i. 75, 76.
plate, i. 28.
teeth, i. 70.
- Aural disease**, eye-lesions in, i. 547-559.
vertigo, i. 531-533.
- Auricle**, i. 33.
abscess of, i. 151.
angioma of, i. 159, 160.
atheroma of, i. 158, 159.
benign tumors of, i. 156-162.
- Auricle**, carcinoma of, i. 162-164.
cutaneous diseases of, i. 133-143.
cystoma of, i. 160-162.
detachment of, i. 226-229.
eczema of, i. 134-138.
erysipelas of, i. 150, 151.
fasciæ of, i. 34.
fibroma of, i. 156-158.
gangrene of, i. 153.
herpes of, i. 139-141.
inflammatory affections of, i. 148-156.
intertrigo, i. 133.
ligaments of, i. 34.
lupus of, i. 141-145.
malignant tumors of, i. 162-165.
muscles of, i. 35.
nerves of muscles of, i. 36.
ossification of, i. 152.
othæmatoma, i. 153-156.
papilloma of, i. 162.
pemphigus of, i. 138-139.
perichondritis of, i. 148-150.
chronic, of, i. 147, 148.
sarcoma of, i. 164, 165.
sebaceous tumors of, i. 158, 159.
syphilis of, i. 141-143.
wounds and injuries of, i. 145-148.
- Auricular appendages**, i. 130, 131.
muscles, antitragicus, i. 36.
helicis major, i. 36.
minor, i. 36.
obliquus auris, i. 36.
tragicus, i. 36.
transversus auriculæ, i. 36.
- Auscultation-tube**, Burnett's method of using, i. 116.
Toynbee's aural, i. 111.
- Autophony**, i. 276, 347.

B.

- Baber**, E. Cresswell, M.B. (London), on foreign bodies in the nose, and epistaxis, i. 729-743.
- Bacon**, Gorham, M.D., on diseases and injuries of the membrana tympani, and acute otitis media, including preventive hygiene, i. 255-323.
- Barclay**, Robert, A.M., M.D., on acute and chronic otitis externa, including otomycosis and cancer of the auditory canal, p. 166-217.
- Bathing for subjects of acute rhinitis**, i. 617-619.
- Bean**, C. E., M.D., on acute tonsillitis, ii. 274-284.
- Blake**, Clarence J., A.M., M.D., on acute and chronic inflammation of the mastoid portion of the temporal bone, i. 481-517.
- Bleeding**, local, in acute otitis media, i. 291.
- Blepharospasm from adenoids in naso-pharynx**, ii. 168.
- Blindness from pressure in nasal disease**, ii. 158.
- Boils in the external ear**, i. 166-172.
- Bone**, turbinated, inferior, i. 563.
middle, i. 563.
superior, i. 564.
- Bone-conduction**, i. 89-93.
in chronic aural catarrh, i. 354.
- Bosworth**, Francke H., M.D., on acute rhinitis, i. 611-624.
on hay-fever, ii. 66-89.
- Bougies**, medicated, for nose and throat, i. 608, 609.
- Brain abscess**, chronic purulent otitis media, i. 456-458.
encysted, i. 454, 455.
in ear-disease, i. 555, 556.
- Bright's disease**, effect on middle ear, i. 375, 376.
- Bronchial septum**, ii. 509.

- Bronchus, foreign bodies in, ii. 509-511.
 Browne, Lennox, F.R.C.S. Ed., on deformities and morbid growths of the pharynx and larynx, ii. 709-791.
 Bryan, Joseph H., M.D., on diseases of the accessory sinuses of the nose, i. 743-775.
 Bryant, William Sotier, A.M., M.D., on anatomy and physiology of the ear, and tests of hearing, i. 1-98.
 Bulkley, L. Duncan, M.D., on skin-diseases of the nose, ii. 173-191.
 Burnett, Charles H., A.M., M.D., on chronic purulent otitis media, i. 409-465.

C.

- Cæcum vestibuli (cochlea), i. 72.
 Caisson, effect on ear, i. 256.
 Canal, external auditory, i. 36-42.
 blood-supply, i. 41.
 epithelium of, i. 41.
 fissures of Santorini, i. 40.
 glands, i. 41.
 in chronic aural catarrh, i. 344.
 isthmus of, i. 40.
 length of, i. 39.
 lymph-vessels, i. 42.
 nerves, i. 42.
 section of, i. 37.
 veins, i. 42.
 of Huguier, i. 15.
 posterior, of the chorda tympani, i. 15.
 Canalis membranacea cochleæ, i. 71.
 musculo-tubarius, petrous bone, i. 13, 18, 30.
 reuniens, i. 70.
 spiralis modioli (cochlea), i. 25.
 tensoris tympani, i. 18, 19.
 tympanicus, i. 11.
 Carcinoma of antrum, i. 757.
 auricle, i. 162-164.
 ethmoidal sinuses, i. 763.
 middle ear, i. 463.
 Caries and necrosis of adjacent structures in chronic purulent otitis media, i. 449-456.
 nasal, surgery of, ii. 64.
 Carotid artery, rupture of, in chronic purulent otitis media, i. 454.
 canal, i. 10, 19.
 caries of, i. 454.
 foramen, i. 10.
 Cartilage of auricle, i. 34.
 of nose, i. 560.
 Catarrh, chronic, of middle ear, i. 323-372.
 dry, i. 323.
 exudative, i. 324.
 hypertrophic, of the nose, i. 632-662.
 laryngeal, traumatic, ii. 479-481.
 of the middle ear, sero-mucous, i. 295, 296.
 Catarrhal diathesis, i. 325, 326.
 otitis media, acute, i. 273-294.
 subacute, i. 294-300.
 Catheter, Eustachian, i. 118.
 in chronic aural catarrh, i. 366.
 method of using, i. 119-123.
 Caustics, chemical, in nasal hypertrophy, ii. 41.
 for nose and throat, i. 607, 608.
 Canterbury, electric, in nasal hypertrophy, ii. 42, 43.
 Cavities, accessory, of nose, i. 564.
 diseases, i. 743-775.
 Cerebellar abscess, i. 456, 457.
 Cerebral abscess, i. 456-458.
 causes, i. 456.
 conclusions concerning, i. 457.
 symptoms, i. 456.
 treatment, i. 458.
 lesions from chronic purulent otitis media, i. 455, 456.

- Chapman, S. Hartwell, A.M., M.D., on vocal culture and hygiene, ii. 212-247.
 Chest-capacity in vocal culture, ii. 238, 239.
 Cheval's electro-acoumeter, i. 98.
 Chink of the glottis, ii. 204.
 Cholera, effect on internal ear, i. 526.
 Cholesteatoma of mastoid, i. 504, 505.
 of middle ear, i. 446-449.
 etiology, i. 447-448.
 Stacke's operation, i. 448.
 treatment, i. 448.
 Chondromata, nasal cavities, ii. 16-18.
 Chorda tympani nerve, i. 48, 49, 81.
 Chorditis tuberosa, ii. 473.
 vocalis hypertrophica inferior, ii. 485.
 Chorea, general, connection with internal ear, i. 536.
 of larynx, ii. 678-683.
 reflex, from nasal disease, ii. 133-135.
 Choroid, congestion of, from nasal disease, ii. 169.
 Chronic catarrh of the middle ear, i. 323-373.
 age, i. 328.
 alcohol, effects of, i. 334.
 atrophic stage, i. 340, 341.
 auditory hallucinations, i. 350.
 catarrhal inflammation elsewhere as a cause, i. 335.
 chronic diseases, effect of, i. 333, 334.
 climatic conditions, i. 329-331.
 deafness in, i. 344-348.
 diet, i. 332.
 differential diagnosis of various forms, i. 360, 361.
 diseased teeth in, i. 326.
 electric lamp in excision of membrana and ossicula, i. 370.
 electricity in, i. 367.
 etiology, i. 326-338.
 Eustachian catheter in, i. 366.
 tube in, i. 343.
 excision of the membrana tympani and the two larger ossicula, i. 368-372.
 exciting causes, i. 334.
 external auditory canal in, i. 344.
 exudation, i. 339.
 frequency of, i. 337, 338.
 heredity, i. 326.
 hygienic surroundings, i. 331, 336.
 hyperæmia in, i. 338.
 injection of liquids, i. 367.
 injections of vapors, i. 367.
 inspection of membrana, i. 356-358.
 labyrinth in, i. 343.
 loud noises, effects of, i. 335.
 membrana tympani in, i. 341-343.
 mental strain in, i. 332, 333.
 morbid anatomy, i. 338-344.
 objective signs and diagnosis, i. 353-361.
 ossicles in, i. 343.
 otalgia in, i. 351.
 pain in ear, i. 351.
 paracentesis, i. 367.
 partial excision of membrana tympani, i. 367.
 peculiar modifications of hearing in, i. 347.
 physical strain, i. 332, 333.
 pneumatic tests in, i. 358, 359.

- Chronic catarrh of the middle ear, Politzer bag
in treatment, i. 366.
prognosis, i. 361-363.
proliferation, i. 339.
reflex causes, i. 334, 335.
removal of stapes, i. 465-480.
retraction of membrana tym-
pani, i. 342.
sclerosis, i. 340, 341.
sensations of discomfort, i. 351.
statistics, i. 327, 328.
symptoms, i. 344-353.
tenotomy of stapedius, i. 368.
of tensor tympani, i. 368.
tensor tympani in, i. 343.
tinnitus aurium, i. 348-350.
tobacco, effects of, i. 334.
treatment, i. 363-372.
vertigo, i. 350.
- hypertrophic rhinitis, i. 632-662.
otitis externa, i. 215-217.
purulent otitis media, i. 409-444, 456, 457.
antiseptic powders in, i. 420.
solutions in, i. 418.
appearances of membrana tym-
pani, i. 415, 416.
caries of carotid canal, i. 454.
and necrosis of adjacent
structures, i. 449-456.
of occipital, temporal, and
parietal bones, with
meningitis, i. 454.
of ossicles and inner tym-
panic wall, i. 451.
cases of excision of membrana
and ossicula, i. 431-433.
cause of intra-cranial lesions,
i. 455, 456.
cerebral abscess from, i. 456-
458.
cholesteatoma, i. 446-449.
chronic suppuration of the
atrium, i. 413-434.
electric lamp in excision of
membrana and ossicula, i.
428, 429.
encysted cerebral abscess, i.
454, 455.
etiology, i. 410, 411.
excision of membrana tympani
and ossicula, i. 427-434.
of membrana and ossicula
in chronic suppuration
of the attic, i. 439.
exfoliation of cochlea, i. 452.
of internal ear, i. 452.
exostoses in auditory canal
complicating chronic otor-
rhœa, i. 444.
facial paralysis, i. 451-453.
fatality, i. 447.
granulations, i. 420.
malignant disease from, i. 463,
464.
meningitis, i. 460-462.
metastasis, i. 462.
paralysis of fifth, sixth, and
seventh nerves, i. 454.
perforation of the membrana
flaccida, i. 434-436.
phlebitis of lateral sinus and
jugular vein, i. 458-460.
polypi, i. 420-423.
pyæmia, i. 462.
removal of stapes in, i. 465-
480.
rupture of carotid artery, i. 454.
- Chronic purulent otitis media, seat of intra-
cranial lesions, i. 455.
sequelæ, i. 444-465.
suppuration in the attic, i. 434-
444.
symptoms, i. 411-413.
of cerebral abscess, i. 451.
of sinus-thrombosis, i. 459,
460.
temperature lines in intra-
cranial lesions, i. 462.
thrombosis of lateral sinus and
jugular vein, i. 458-460.
treatment of suppuration of
the atrium, i. 416-434.
of suppuration of the attic,
i. 436-444.
- Circumscribed otitis externa, i. 166-172.
Cirrrosis, turbinate, i. 674.
Cisterna perilymphatica, i. 66.
Clamp-splint, nasal, ii. 57.
Cleveland, Arthur H., B.S., M.D., on ocular
lesions in aural diseases, and coincident ocular
and aural disorders in systemic disturbances, i.
547-560.
- Clothing in subjects of acute rhinitis, i. 616, 617.
Cocaine in nasal surgery, ii. 40.
Cochlea, i. 24-26.
anæmia of, i. 526.
canalis spiralis modioli, i. 25.
cochlear canal, i. 24.
coils of, i. 25, 72.
cupola, i. 25.
exfoliation of, i. 452.
functions of, i. 91.
hamulus Scarpæ, i. 25.
hyperæmia of, i. 526.
infundibulum, i. 24.
lamina modioli, i. 24.
spiralis accessoria, i. 26.
modiolus, i. 24.
scalæ, i. 25.
sulcus spiralis, i. 26.
- Cochlea, membranous, i. 70-76.
auditory teeth, i. 70.
cæcum vestibuli, i. 72.
canalis membranacea cochleæ, i. 71.
coils, i. 72.
Corti's arch, i. 73.
cells, i. 75.
membrane, i. 75.
organ, i. 73-75.
rods, i. 73.
tunnel, i. 73.
crista ligamenti spiralis, i. 71.
spiralis, i. 70.
Deiters's cells, i. 75.
ductus cochleæ, i. 75.
hair cells, i. 74.
Hensen's stripe, i. 75.
supporting cells, i. 75.
labium tympanicum, i. 70.
vestibulare, i. 70.
lagna, i. 72.
ligamentum spirale, i. 71.
limbus laminæ spiralis, i. 70.
membrana tectoria, i. 75.
Nuel's space, i. 74.
papilla acustica, i. 73.
pars vestibuli, i. 72.
Reissner's membrane, i. 71.
scala media, i. 71.
sulcus ligamenti spiralis, i. 71.
spiralis, i. 70.
spiral canal, i. 71.
stria vascularis, i. 71.
zona pectinata, i. 73.

- Cochlea, membranous, zona perforata, i. 73.
tecta, i. 73.
- Cochlear canal, i. 24.
- Cohen, J. Solis, on tuberculosis and syphilis of the larynx, ii. 792-825.
- "Cold in head," caused by ametropia, ii. 171.
- Colles, Christopher J., M.D., on the middle ear in renal, malarial, syphilitic, gouty, rheumatic, and dental diseases; with a consideration of objective noises in the ear, i. 373-409.
- Compsomyia macellaria, eggs of, in nose, i. 772, 773.
- Concha auriculæ, i. 33.
- Conchæ eminentia, i. 34.
- Conjunctivitis from adenoids in naso-pharynx, ii. 168.
from nasal disease, ii. 155.
- Congenital deafness, i. 540.
- Consonants, self-sounding, of Wolf, as tests of hearing, i. 97.
- Constitutional diseases, effects on internal ear, i. 525, 526.
- Corneal inflammation from nasal disease, ii. 159.
ulceration from oxæna, ii. 161.
- Corneitis from adenoid growths in naso-pharynx, ii. 168.
- Cornicula laryngis, ii. 201.
- Corti's arch, i. 73.
cells, i. 75.
closed tunnel, i. 73.
membrane, i. 75.
organ, i. 73-75.
rods, i. 73.
- Cough from nasal disease, ii. 109-112.
- Crico-arytenoid articulation, ii. 202.
ligament, ii. 202.
- Cricoid cartilage, ii. 200.
- Crico-thyroid membrane, ii. 202.
- Crico-tracheal ligament, ii. 202.
- Crista acustica, i. 69.
falceiformis, i. 11.
helicis, i. 33.
ligamenti spiralis, i. 71.
Reissneri, i. 17.
spinarum, i. 28.
spiralis, i. 70.
tegminis mastoidei, i. 14.
tympani, i. 14.
transversa tympani, i. 14.
tympanica, i. 28.
- Croup, ii. 328-343.
intubation, ii. 390-396.
laryngismus stridulus, ii. 336-339.
membranous, idiopathic, ii. 328-334.
spasm of the glottis, ii. 336-339.
in adults, ii. 339-342.
spasmodic, ii. 334-336.
laryngitis, ii. 334-336.
surgical anatomy of the pre-tracheal space, ii. 396-399.
treatment, ii. 390-411.
tracheotomy, ii. 396-401.
choice of operation, ii. 401.
- Croupous otitis externa, i. 181-186.
- Crura antihelicis, i. 33.
- Cupola (attic), i. 54.
- Cupping-glass in acute otitis media, i. 291.
- Curettes, aural, i. 108.
- Cystoma of auricle, i. 160-162.
of larynx, ii. 759.
- Cysts of antrum, i. 756, 757.
- Dacryocysto-blennorrhœa from atrophic rhinitis, ii. 165.
from disease of nasal septum, ii. 165.
from hypertrophy of turbinates, ii. 165.
- Dalby, Sir William Bartlett, F.R.C.S., M.B. (Cantab.), on foreign bodies and osseous growths in the external auditory canal, including neoplastic closure, i. 218-255.
- Deaf, acoustic aid and aural hygiene of the, i. 537-546.
- Deafness, causes of, i. 540, 541.
chronic aural catarrh, i. 344-348.
congenital, i. 540.
hereditary, i. 540.
hysterical, i. 526, 527.
- Deformities, nasal cavities, ii. 37, 38.
- Deglutition, ii. 197, 198.
painful, i. 591.
- Deiters's cells, i. 75.
- De la Sota y Lastra, Ramon, M.D., Ph.D., LL.D., on lupous and leprous laryngitis, ii. 412-456.
- Dench, Edward B., Ph.B., M.D., on congenital malformations, cutaneous diseases, morbid growths, and injuries of the auricle, i. 124-165.
- Diabetes, effect on ear, i. 557.
- Dilators, metallic, for nose and throat, i. 609.
- Diphtheria, ii. 343-390.
age of patients, ii. 349-351.
antrum, i. 755.
bacillus, ii. 343-345.
diagnosis, ii. 357-359.
differential diagnosis, ii. 359-363.
diphtheritic exudate, ii. 359.
diphtheroid, ii. 360.
effect on ear, i. 559.
incubative period, ii. 351, 352.
intubation, ii. 390-396.
microbe, ii. 343-345.
modes of propagation, ii. 352-357.
of the nose and naso-pharynx, i. 719-728.
extension, i. 724-728.
primary, i. 719-724.
secondary, i. 724-728.
treatment, i. 725-728.
- prophylaxis, ii. 363-369.
pseudo-diphtheria, ii. 345, 349, 360.
treatment, ii. 369-389.
hygienic, ii. 369-371.
internal, ii. 378-389.
local, ii. 371-378.
surgical, ii. 390-411.
tracheotomy, ii. 396-401.
vitality of Klebs-Loeffler bacillus, ii. 348.
- Diphtheritic otitis externa, i. 181-186.
- Diplacusis, i. 347.
- Dissecting otitis externa, i. 181-186.
- Dobell's solution, i. 646.
- Double hearing, i. 276.
- Douche, nasal, i. 598.
pharyngeal, i. 599.
Thudichum's, i. 598.
- Drills, surgical, in septum-deformities, ii. 53-56.
- Ducts emptying into nasal meatuses, i. 564, 565.
- Ductus cochleæ, i. 75.
endolymphaticus, i. 67, 70.
perilymphaticus, labyrinth, i. 66.
- Dysacusma, i. 347.
- Dysæsthesia acustica, i. 347.
- Dysphagia, ii. 704-708.
- Dyspnoea, i. 592.

D.

Dabney, Samuel G., M.D., on methods of examination and diagnosis of diseases of the nose, naso-pharynx, and larynx, i. 576-593.

E.

Ear, external, i. 33-42.
in general dyscrasiæ, i. 557-559.
internal, i. 65-76, 517-520.

- Ear, malformations of, i. 124-133.**
 middle, i. 42-65.
 objective noises in, i. 401-408.
 physiology of, i. 83-92.
 protective apparatus, i. 88, 89.
 reflexes in, from nasal disease, ii. 128.
 relation of nose to, i. 571.
- Ear-cough, i. 230, 231.**
- Ear-disease, brain-abscess in, i. 555, 556.**
 from diabetes, i. 557.
 diphtheria, i. 559.
 disorders of nervous system, i. 554
 epilepsy, i. 556.
 exanthemata, i. 559
 glaucoma, i. 553.
 gout, i. 559.
 grippe, i. 559.
 hydrocephalus, i. 556.
 influenza, i. 559.
 intra-cranial growths, i. 555.
 leukæmia, i. 554.
 meningitis, i. 554.
 epidemic cerebro-spinal, i. 556.
 nephritis, i. 557.
 posterior sclerosis of spinal cord, i. 556.
 pseudo-leukæmia, i. 554.
 relapsing fever, i. 558.
 syphilis, i. 558.
 tuberculosis, i. 556.
 typhoid fever, i. 558.
 whooping-cough, i. 559.
- Ear-diseases, nystagmus in, i. 552.**
 optic neuritis in, i. 549-551.
 paralysis of cranial nerves in, i. 551.
 suppurative of eye in, i. 552.
- Ear-fungi, i. 190-215.**
- Echondrosis, nasal cavities, ii. 29, 30.**
- Écraseur for nasal adenoids, ii. 61, 62.**
 nasal, in hypertrophies, ii. 44.
 septum-operations, ii. 50, 51.
- Eczema of auricle, i. 134-138.**
 of nose, ii. 175-177.
- Electric illumination of antrum, i. 749, 750.**
 lamp, use of, in excision of membrana tympani and ossicles, i. 370, 428, 429.
- Electrical tests of hearing, i. 98.**
- Electricity in chronic aural catarrh, i. 367.**
- Emboli, effect on eye and ear, i. 553.**
- Eminentia Fallopii, i. 16.**
 pyramidalis, i. 16.
 styloidea, i. 15.
- Emphysema from Eustachian catheter, i. 121, 122.**
 of skin, inner canthus, from blowing nose, ii. 157.
- Empyema of antrum of Highmore cause of eye-disease, ii. 155.**
 of frontal sinuses, i. 768-771.
 of maxillary sinuses, i. 744-755.
 antroscope, i. 755.
 antrum-drill, i. 753.
 diagnosis, i. 747-750.
 electric illumination of antrum, i. 749, 750.
 etiology, i. 744, 745.
 prognosis, i. 750.
 symptoms, i. 745-747.
 treatment, i. 750-755.
- Enchondroma laryngis, ii. 482.**
- Enchondromata of larynx, ii. 761, 762.**
- Endolymph, internal ear, i. 66.**
- Endolymphatic sac, membranous labyrinth, i. 67.**
- Epiglottis, ii. 195, 200.**
 crest of, ii. 203.
 cushion of, ii. 203.
 tuberculous ulceration, ii. 793.
- Epiglottitis, acute miasmatic, ii. 313.**
- Epilepsy, effect on ear, i. 556.**
 from foreign body in ear, i. 231.
 from nasal disease, ii. 135, 136.
 reflex nasal, ii. 135, 136.
- Epitotic centre, i. 30.**
- Epiphora from nasal disease, ii. 155, 164.**
 from ozæna, ii. 163, 164, 172.
- Epistaxis, i. 586, 738-742.**
 plugging nares, i. 741.
- Epithelial plug in mastoid, i. 503.**
- Epithelioma of the nose, ii. 177-179.**
- Epitheliomata of larynx, ii. 773-778.**
 (carcinomata) of pharynx, ii. 731-734.
- Erectile spaces, obliteration of, in nasal inflammation, i. 670, 671.**
 tissue, nasal cavities, ii. 5, 6.
 of turbinated bones, i. 566.
 tumors, nasal cavities, ii. 15, 16.
- Eruptions on the nose from bromide and iodide of potassium, ii. 191.**
- Erysipelas in inflammation of the ear, i. 305, 308, 309.**
 of antrum, i. 756.
 of auricle, i. 150, 151.
 of nose, ii. 179, 180.
 of pharynx, ii. 268.
- Erythema of the nose, ii. 180.**
- Ethmoidal sinuses, i. 564.**
 diseases of, i. 758-763.
 carcinoma, i. 763.
 diagnosis, i. 760.
 etiology, i. 758, 759.
 fibroma, i. 763.
 mucocoele, i. 762.
 osteoma, i. 763.
 polyp, i. 763.
 prognosis, i. 760.
 sarcoma, i. 763.
 symptoms, i. 759, 760.
 treatment, i. 760-762.
- Eustachian catheter, i. 118.**
 emphysema from use of, i. 121, 122.
 method of using, i. 119-123.
- salpingitis, i. 658.**
 treatment, i. 659-662.
- tube, i. 15, 17, 61-65.**
 affections of, in chronic rhinitis, i. 655-662.
 canalis musculo-tubarius, i. 18.
 tensoris tympani, i. 18.
 cartilage of, i. 62.
 fossa of Rosenmüller, i. 61.
 glands, i. 63.
 in chronic aural catarrh, i. 343.
 infants, i. 64.
 isthmus, i. 62.
 lengths, i. 64.
 lumen, i. 63, 64.
 measurements, i. 17.
 membranous part, i. 63.
 muscles, i. 64, 65, 574.
 nerves of, i. 60.
 osseous part, i. 17.
 ostium tympanicum tubæ, i. 18.
 parts, i. 61.
 patency, i. 111.
 physiology, i. 87, 88.
 septum tubæ, i. 18.
 tonsil of, i. 63.
 warm-water injections in acute otitis media, i. 321.
- Examination of the ear, i. 99-121.**
 laryngoscopic image, i. 589.
 larynx, i. 588-591.
 naso-pharynx, i. 582-588.
 nose, i. 576-582.
- Exanthemata, effect on ear, i. 559.**

- Excision of membrana and ossicula**, i. 367, 368-372, 444.
 chronic aural catarrh, i. 368-372.
 purulency of the atrium (middle ear), i. 427-434.
 conclusions, i. 444.
 in nasal hypertrophy, ii. 43-47.
 partial, of membrana tympani in chronic aural catarrh, i. 367.
- Exostoses**, nasal cavities, ii. 31, 32.
- Exostosis in auditory canal**, i. 232, 233.
 complication in chronic purulency of the middle ear, i. 444.
- External ear**, i. 33-42.
 auricle, i. 33.
 physiology, i. 83-85.
 pinna, i. 33.
- Exudative catarrh of middle ear**, i. 324.
- Eye**, diseases of, dependent upon diseases of the nose, ii. 149-172.
 accessory nasal cavities, ii. 164.
 adenoid growths in naso-pharynx, ii. 168.
 asthenopia, ii. 153.
 astigmatism, ii. 153.
 atrophic rhinitis, ii. 161, 165.
 atrophy of optic disk, ii. 154.
 congenital optic atrophy, ii. 153.
 coryza, ii. 156.
 diseases of ethmoid, sphenoid, the frontal and maxillary sinuses, ii. 154-157.
 of lachrymal excretory apparatus, ii. 162.
 of middle turbinate, ii. 158.
 empyema of antrum of Highmore, ii. 155.
 of maxillary sinus, ii. 156.
 ethmoidal sinuses, diseases of, ii. 154.
 evils of prolonged use of cocaine in the nose, ii. 156.
 from disease of the sphenoidal sinuses, ii. 154.
 gonorrhoeal nasal cavities, ii. 159.
 hydrops of frontal sinus, ii. 165.
 hypertrophy of lower turbinates, ii. 160.
 in strumous nasal organs, ii. 159.
 indirect nasal origin, ii. 168-171.
 Leber's disease, ii. 153.
 mechanically-caused abnormality of the eyes starting in the nose, or in communicating and adjacent structures, ii. 157, 158.
 middle turbinate, ii. 162.
 nasal cautery, ii. 164.
 hydrorrhoea, ii. 155, 156.
 tumors, ii. 158, 165, 168.
 necrosis of os planum, ii. 155.
 of sphenoidal sinuses, ii. 156.
 ocular lesions caused by the transfer of pathogenic material from the nose to the eye by way of the lachrymal canal, ii. 158-162.
 ozena, ii. 159.
 presbyopia in children, 153.
 rhinitis, ii. 160.
- Eye**, diseases of, dependent upon diseases of the nose, rhinitis syphilitica, ii. 163.
 sneezing, ii. 157.
 strabismus, ii. 153.
 supra-orbital neuralgia, ii. 155.
 tumors of sphenoidal sinuses, ii. 157.
 reflexes in, from nasal disease, ii. 128-131.
- Eye- and ear-diseases**, coincident, in systemic disorders, i. 553-557.
 lesions of, in aural diseases, i. 547-559.
 relationship with internal ear, i. 533-535.
- Eyeball**, disease of, from nasal tumors, ii. 168.
 expression of, by tumors of sphenoidal and ethmoidal sinuses, ii. 157.
 suppuration of, in ear-diseases, i. 552.
- Eye-diseases**, reflex nasal, ii. 128-131.
 secondarily affecting the nose, ii. 171-173.

F.

- Facial expression in disease of nose and naso-pharynx**, i. 587.
 paralysis, i. 451, 453, 454.
 tympanic muscles in, i. 59.
- False hearing**, i. 347.
- Farcy**, i. 715, 716.
- Fascia**, superficial temporal, i. 35.
- Fasciæ of auricle**, i. 34.
 of petrous bone, i. 32.
- Fatality of chronic suppuration of the middle ear**, i. 447.
- Fauces**, ii. 192.
- Fenestra ovalis**, i. 16.
 rotunda, i. 17.
- Fevers**, larynx and pharynx in, ii. 622-663.
- Fibro-cellular growths**, ii. 757, 758.
- Fibroids**, nasal cavities, ii. 12, 13.
- Fibroma of auricle**, i. 156-158.
 of ethmoidal sinuses, i. 763.
- Fibromata of larynx**, ii. 756, 757.
- Fissura mucosa inter-arytenoidea**, ii. 315.
 vestibuli (Gruber), i. 17.
- Fistula auris congenita**, i. 131-133.
- Floor of the tympanum**, i. 14.
- Folds**, mastoid antrum, i. 57.
 membranæ tympani, i. 45.
- Foramen centrale cochleæ**, i. 11.
 lacerum medium, i. 11, 13.
 singulare, petrous bone, i. 11.
- Forceps**, aural, i. 109.
 Gradle's, i. 288.
- Foreign bodies in the bronchi**, ii. 509-511.
 external ear, i. 218-229.
 ear-cough from, i. 230, 231.
 epilepsy from, i. 231.
 treatment, i. 220-229.
 frontal sinuses, i. 772-774.
 larynx, ii. 500-533.
 nasal cavities, ii. 32-35.
 surgery, ii. 51-53.
 nose, i. 729-738.
 oesophagus, ii. 533-570.
 pharynx, ii. 533-570.
 trachea, ii. 500-533.
- Fossa capitelli**, i. 16.
 helicis (auricle), i. 33.
 intercircularis (auricle), i. 33.
 Rosenmüller's, Eustachian tube, i. 573.
 scaphoidea helicis, i. 33.
 subarcuata (petrous bone), i. 12, 30.
- Fovea hemisphærica (vestibule)**, i. 69.
- Fracture of base of skull**, internal ear in, i. 525.
- Frontal sinuses**, i. 564.
 acute inflammation of the mucous membrane, i. 766, 767.

Frontal sinuses, diseases of, i. 766-775.
 empyema, i. 768-771.
 foreign bodies in, i. 772-774.
 mucocele, i. 767, 768.
 screw-worm in, i. 772-774.
 tumors, i. 771, 772.

Fungi, aural, i. 190-215.
Aspergillus flavus, i. 195.
fumigatus, i. 196.
nidulans, i. 200.
niger, i. 195.
 diagnosis, i. 209.
Eurotium repens, i. 206.
 growth of mycelium, i. 203-208.
 Mayer's fungus, i. 195.
Mucor corymbifer, i. 197.
septatus, i. 199.
mucorini, i. 203.
Otomycos purpureus, i. 196.
Pacini's fungus, i. 195.
Penicillium glaucum, i. 196, 198.
 physical symptoms, i. 209.
 prognosis, i. 212.
 rational symptoms, i. 209.
Sphærothecæ, i. 208.
pannosa, i. 207.
 treatment, i. 212-215.
Verticillium graphii, i. 198.

Furuncles of ear in diabetes, i. 557.

G.

Galton's whistle, i. 96.
 Galvanic current, nose and throat, i. 608.
 Galvano-cautery for nose and throat, i. 608.

Ganglion of Andersch, i. 81.
Gasserian, i. 12, 32, 82.
geniculate, i. 80.
petrosal, i. 81.
petrous, i. 81.
spirale, i. 78.

Gangrene of auricle, i. 153.
Gasserian ganglion, i. 12, 32, 82.

Glanders, chronic, i. 715.
 diagnosis, i. 719.
 horse, i. 715.
 man, i. 716-719.
 nose, i. 715-719.
 prognosis, i. 718.
 treatment, i. 719.

Glaserian fissure, i. 15, 29, 30.

Glasgow, William Carr, M.D., on croup, ii. 328-343.

Glaucoma, effect on ear, i. 553.
 from nasal disease, ii. 156.
 from *ozæna*, ii. 159.

Glenoid fossa, i. 3.

Glosso-epiglottic ligament, median, larynx, ii. 202.

Glottis, spasm of, in adults, ii. 339-342, 677, 678.
 in children, ii. 336-339, 674-677.

Gonorrhœa, nasal cavities, ii. 159.

Gottstein's basal process, i. 73.

Gould, George M., A.M., M.D., on diseases of the eye dependent upon diseases of the nose, and reflex nasal disease due to ocular maladies, ii. 149-172.

Gout as cause of hay-fever, ii. 73.
 effect on the ear, i. 559.
 on the middle ear, i. 393-396.

Gouty sore throat, ii. 273.

Granular lids with disease of lower turbinates, ii. 160.

Granulations in chronic purulent otitis media, i. 420.

Graves's disease from nasal disease, ii. 137, 138.
 reflex nasal, ii. 137, 138.

Grippe, American, i. 626-631.
 cause of otitis media, i. 313, 314.
 effect on ear, i. 559.

Gruber's inflation of the tympana, i. 113.

Gummata, larynx, ii. 818.
 nasal cavities, ii. 21-23.

Gyrus fusiformis, i. 32.
hippocampi, i. 32.
 inferior, i. 32.

H.

Hæmatoma of nose, ii. 65.

Hæmostatic clamp (Jarvis's) in nasal surgery, ii. 51.

Hair cells, i. 74.

Hallucinations, auditory, in chronic aural catarrh, i. 350.

Hamulus Scarpæ, i. 25.

Hay-fever, ii. 66-89.
 age, ii. 72.
 course, ii. 78.
 definition, ii. 66, 67.
 diagnosis, ii. 81, 82.
 duration, ii. 79, 80.
 etiology, ii. 67, 73.
 from eye-disease, ii. 172.
 geographical distribution, ii. 80, 81.
 gout in, ii. 73.
 history, ii. 66, 67.
 nasal disease in, ii. 70-73.
 neurosis, ii. 73.
 neurotic habit, ii. 70.
 pathology, ii. 73-75.
 pollen as cause, ii. 68, 69.
 prognosis, ii. 82, 83.
 psychic influence in, ii. 72.
 symptomatology, ii. 75-78.
 treatment, ii. 83-89.

Headaches, reflex nasal, ii. 131-133.

Head-mirror, i. 577.

Hearing, double, i. 276.
 tests of, i. 92-98.

Heart, reflex nasal irritation, ii. 137.

Helicis major, i. 36.

Helicotrema, labyrinth, i. 66.

Helix of auricle, i. 33.
 of ear, anomalies of, i. 123.
 process of, i. 34.

Hemorrhage from the internal ear, i. 524, 525.
 in nasal operations, ii. 40.
 retinal, from sneezing, ii. 157.
 subconjunctival, from nasal irritation, ii. 157.

Hemorrhages in eye, effect on ear, i. 554.

Hemorrhoids, lingual, i. 589.

Hensen's stripe, i. 75.
 supporting cells, i. 75.

Herededitary deafness, i. 540.

Herpes of auricle, i. 139-141.
 of pharynx, ii. 270, 271.

Hiatus Fallopii, i. 11, 12.

Hiccough from nasal disease, ii. 113.

Highmore, antrum of, i. 564.

Huschke, canal of, i. 29.

Hydrocephalus, internal, effect on ear, i. 556.

Ilio-epiglottic ligament, larynx, ii. 201.

Hyoid bone, ii. 199.

Hyperæmia of brain, effect on ear, i. 554.

Hyperæsthesia acustica, i. 530, 531.
 of larynx, ii. 670, 671.
 of nose, ii. 107, 108.

Hyperosmia, ii. 91.

Hyperosphresia, ii. 91.

Hyperostosis in auditory canal, i. 233-238.
 in mastoid inflammation, i. 503.

Hyperplasias, nasal cavities, ii. 26-29.

- Hypertrophies, nasal cavities, ii. 27-29.
 posterior, surgery of, ii. 45.
 of turbinated bodies, i. 640-644.
 Hypertrophy of turbinated tissue, surgery of, ii.
 41-47.
 Hysteria, nasal reflex, ii. 140-142.
 Hysterical deafness, i. 526, 527.

I.

- Incisura intertragica, i. 33.
 Rivini, i. 15, 29.
 Incus, i. 20, 21.
 articulation, i. 52.
 body, i. 21.
 cog, i. 21.
 crest, i. 21.
 development, i. 27.
 external mucous fold, i. 53.
 long process, i. 21.
 physiology, i. 85, 86.
 processus lenticularis, i. 21.
 short process of, i. 21.
 stapes joint, i. 52.
 Inflation of tympana, Gruber's method, i. 113.
 Politzer's i. 112, 113.
 Valsalva's, i. 112.
 Inflation-bag, Buck nose-piece, i. 113.
 Politzer's, i. 113.
 Influenza, i. 624-626.
 cause of otitis media, i. 313, 314.
 definition, i. 624.
 effect on ear, i. 559.
 treatment, i. 625, 626.
 Ingals, E. Fletcher, M.D., on chronic pharyn-
 gitis, ii. 284-304.
 Inhalations for throat, i. 605-607.
 Inhalers, i. 605.
 Instruments, hearing, i. 542-546.
 for operating on larynx, i. 610.
 on nose and naso-pharynx, i. 610.
 on pharynx, i. 610.
 Insufflators, i. 599-602.
 Internal ear, anatomy of, i. 65-76, 517-520.
 diseases of, i. 517-537.
 aural vertigo, i. 531-533.
 cholera, effects on, i. 526.
 concussion of labyrinth, i. 522-524.
 due to changes in the economy, i.
 625.
 fracture at base of skull, i. 524, 525.
 general chorea, i. 536.
 hemorrhage from, i. 524, 525.
 hyperæsthesia acustica, i. 530, 531.
 hysterical deafness, i. 526, 527.
 malformations, i. 536.
 metastasis of mumps, i. 528.
 panotitis, i. 528-530.
 primary acute labyrinthitis, i. 530.
 suppurative exfoliation of, i. 452,
 453.
 syphilis, i. 527.
 tuberculosis, i. 526.
 typhoid fever, i. 526.
 endolymph, i. 66.
 membranous labyrinth, i. 65.
 perilymph, i. 66.
 physiology of, i. 520-522.
 relationship with eye, i. 533-535.
 Intertrigo of auricle, i. 133.
 Intrinsic muscles of tympanum, nerves of, i. 58.
 Intubation of larynx, ii. 390-396.
 Intumescencia gangliiformis, i. 78.
 Iritis from empyema of antrum of Highmore, ii.
 155.
 from nasal disease, ii. 158.
 from ozæna, ii. 159.

J.

- Jack, Frederick L., M.D., on removal of the
 stapes in chronic catarrhal and in chronic sup-
 purative otitis media, i. 465-481.
 Jacobson's nerve, i. 16, 60, 81.
 Jarvis, William Chapman, M.D., on surgical pro-
 cedures in deformities and neoplastic growths
 in the nose, ii. 39-65.
 Jugular facet, i. 10.
 fossa, i. 10, 19.
 vein, phlebitis of, i. 458-460.
 symptoms of thrombosis, i. 460.
 thrombosis of, i. 458-460.

K.

- Keratitis from nasal disease, ii. 160.
 from ozæna, ii. 159, 161.
 Knife in septum deformities, ii. 48.
 Knight, Charles H., M.D., on chronic disease of
 the tonsils, ii. 571-621.
 König's rods, i. 95.

L.

- Labium tympanicum, i. 70.
 vestibulare, i. 70.
 Labyrinth, concussion of, i. 261, 522-524.
 membranous, i. 65, 67.
 blood-vessels, i. 76.
 canalis reuniens, i. 70.
 cisterna perilymphatica, i. 66.
 ductus endolymphaticus, i. 67, 70.
 perilymphaticus, i. 66.
 fovea hemisphærica, i. 69.
 hamulus Scarpæ, i. 66.
 helicotrema, i. 66.
 lymphatics, i. 76.
 macula acustica, i. 67.
 membrana tympani secundaria, i. 66.
 otoliths, i. 68.
 perilymphatic spaces, i. 66.
 recessus Cotugnii, i. 67.
 sacculæ, i. 69.
 semicircular canals, i. 68.
 sinus utricularis, i. 69, 70.
 subarachnoid space, i. 66.
 veins, i. 76.
 osseous, i. 22.
 vestibule, i. 23.
 Labyrinthitis, primary acute, i. 530.
 Lachrymal canal, compression of, from nasal
 disease, ii. 165.
 duct, compression of, from malignant tumors,
 ii. 165.
 excretory apparatus, diseases of, from nasal
 disease, ii. 162.
 inflammation of, from nasal
 disease, ii. 162.
 obstruction from chronic nasal catarrh, ii.
 165, 166.
 from disease of middle turbinated bone,
 ii. 158.
 from nasal disease, ii. 158.
 treatment, ii. 166-168.
 sac, compression of, from nasal disease, ii.
 164, 165.
 Lachrymation from nasal disease, ii. 163.
 reflex nasal, ii. 128.
 Lagena, labyrinth, i. 66, 72.
 Lamina cribrosa, i. 11.
 spiralis ossea, i. 17.
 ossea accessoria, i. 17.
 Laryngeal cough, i. 591.
 pain, i. 592.

- Laryngeal paralysis** from disease or injury of the inferior (recurrent) laryngeal nerves, ii. 685-688.
- from disease or injury of medulla and nucleus of spinal accessory nerve, ii. 683, 684.
- from disease or injury of pneumogastric, ii. 684.
- from disease or injury of superior laryngeal nerve, ii. 684, 685.
- spasm in the adult, ii. 342.
- Laryngismus stridulus**, ii. 336-339.
- reflex nasal, ii. 114.
- Laryngitis**, acute, ii. 305-327.
- epiglottitis, acute "miasmatic," ii. 313.
- etiology, ii. 305-310.
- "fissura mucosa inter-arytenoidea," ii. 315.
- in young children, ii. 321-322.
- oedema, acute, ii. 315-316.
- of epiglottis, ii. 313.
- subglottic, ii. 318, 319.
- pathology, ii. 310-311.
- "rugæ" of inter-arytenoid space, ii. 316.
- symptoms, ii. 311-323.
- treatment, ii. 323-327.
- catarrhal**, ii. 305-327.
- chronic**, ii. 457-499.
- classification, ii. 457-459.
- course, ii. 483-486.
- diagnosis, ii. 481-483.
- etiology, ii. 459-467.
- formulæ of medicaments, ii. 495-499.
- hyperæmia, ii. 469, 470.
- hyperplastic form, ii. 470, 471.
- hypertrophic form, ii. 472, 473.
- laryngoscopic appearances, ii. 469-475.
- oedematous form, ii. 471, 472.
- pachydermia laryngis, ii. 473.
- pathology, ii. 475-479.
- symptomatology, ii. 467-469.
- termination, ii. 483-486.
- traumatic, ii. 479-481.
- treatment, ii. 486-499.
- climatic, ii. 487, 488.
- electrical, ii. 488.
- hygienic, ii. 487.
- medicinal, ii. 486, 487.
- special forms, ii. 491-495.
- topical, ii. 489-491.
- hæmorrhagia**, ii. 474, 475.
- hypertrophica chronica inferior**, ii. 473.
- leptous**, ii. 435-456.
- definition, ii. 435.
- diagnosis, ii. 450-452.
- duration, ii. 447.
- etiology, ii. 436-441.
- frequency, ii. 435, 436.
- march, ii. 447.
- pathology, ii. 447-450.
- prognosis, ii. 452.
- symptoms, ii. 441-447.
- termination, ii. 447.
- treatment, ii. 452-456.
- lupous**, ii. 412-435.
- definition, ii. 412.
- diagnosis, ii. 424-428.
- duration, ii. 423.
- etiology, ii. 414-417.
- frequency, ii. 413, 414.
- pathology, ii. 424.
- prognosis, ii. 428.
- symptoms, ii. 417-423.
- treatment, ii. 428-435.
- tuberculine, ii. 430, 431.
- simple, ii. 305-327.
- Laryngitis**, spasmodic, ii. 334-336.
- syphilitic, ii. 813-825.
- Laryngo-pharynx**, i. 572; ii. 195.
- Laryngoscope**, i. 578.
- Laryngoscopic image**, i. 589-591.
- Larynx**, acute catarrh, ii. 305-327.
- anatomy, i. 589-591; ii. 198-209.
- anterior commissure, ii. 204.
- arteries, ii. 207, 208.
- ary-epiglottic fold, ii. 203.
- arytenoid muscle, ii. 206.
- chink of the glottis, ii. 204.
- crico-arytenoid articulation, ii. 202.
- ligament, ii. 202.
- crico-thyroid membrane (median ligament), ii. 202.
- epiglottis, crest of, ii. 203.
- cushion of, ii. 203.
- glands, ii. 207.
- glossio-epiglottic ligament, median, ii. 202.
- glottic division of larynx, ii. 204.
- hyo-epiglottic ligament, ii. 201.
- inferior thyro-arytenoid ligaments, ii. 203, 204.
- infra-glottic division of larynx, ii. 204.
- inter-arytenoid space, ii. 204.
- lateral, thyro-hyoid ligaments, ii. 201.
- lymphatics, ii. 208, 209.
- median ligament, ii. 201.
- mucous membrane, ii. 206, 207.
- muscles, ii. 205-206.
- nerves, ii. 208.
- posterior commissure, ii. 204.
- rima glottidis, ii. 204.
- sacculus laryngis, ii. 203.
- sesamoid cartilages, anterior, ii. 201.
- supra-glottic division of larynx, ii. 204.
- thyro-arytenoid ligaments, ii. 203.
- thyro-epiglottic ligament, ii. 202.
- thyro-hyoid ligament, ii. 201.
- membrane, ii. 201.
- veins, ii. 208.
- ventricles of larynx, ii. 203.
- of Morgagni, ii. 203.
- ventricular bands, ii. 203.
- vocal cords, false, ii. 203.
- true, ii. 203, 204.
- anterior commissure, ii. 204.
- arytenoid cartilages, ii. 200.
- cartilages of Santorini, ii. 199, 201, 203.
- of Wrisberg, ii. 199, 201, 203.
- cavity, ii. 203-207.
- cornicula laryngis, ii. 201.
- cricoid cartilage, ii. 200.
- crico-tracheal ligament, ii. 202.
- epiglottis, ii. 200, 201.
- examination of, i. 588, 591.
- female, ii. 218.
- foreign bodies in, ii. 500-533.
- bronchial septum, ii. 509.
- diagnosis, ii. 514-516.
- expulsion, spontaneous, ii. 519, 520.
- modes of entrance, ii. 503-507.
- physical conditions attending lodgement, ii. 507-511.
- prognosis, ii. 516-519.
- spontaneous migration, ii. 519, 520.
- symptoms, ii. 511-514.
- treatment, ii. 520-532.
- bronchotomy, ii. 526, 532.
- crico-thyroid laryngotomy, ii. 526.
- expulsion through natural passages, ii. 520, 522.
- extraction through artificial channels, ii. 526-532.

- Larynx**, foreign bodies in, treatment, extraction through natural passages, ii. 522-526.
 laryngotomy, ii. 527.
 laryngo-tracheotomy, ii. 527.
 pharyngotomy, ii. 527.
 thyroidotomy, ii. 526.
 thyrotomy, ii. 526.
 tracheotomy, ii. 527.
 varieties, ii. 501-503.
 framework, ii. 199.
 glands, ii. 207.
 glottic division, ii. 204.
 hyoid bone, ii. 199.
 in fevers, ii. 622-663.
 infra-glottic division, ii. 204.
 in phonation, ii. 209-211.
 in respiration, ii. 209.
 in singing, ii. 211.
 in speech, ii. 211.
 inter-arytenoid space, ii. 204.
 intubation of, ii. 390-396.
 local therapeutics, i. 593-611.
 lymphatics, ii. 208, 209.
 male, ii. 218.
 malformations, congenital, ii. 734-743.
 dilatations, ii. 737, 768.
 growths, ii. 738-743.
 hypertrophies, ii. 738-743.
 papilloma, ii. 739-743.
 pouches, ii. 737, 738.
 stenosis, ii. 734-737.
 non-congenital, ii. 743-751.
 eversion of ventricle, ii. 750, 751.
 stenosis, ii. 743-750.
 leprous, ii. 750.
 lupous, ii. 747-750.
 syphilitic, ii. 744-747, 825.
 traumatic, ii. 743, 744.
 tubercular, ii. 747.
 malignant growths, ii. 767-781.
 epitheliomata, ii. 773-778.
 etiology, ii. 767-772.
 sarcomata, ii. 778-781.
 syphilis as a cause, ii. 771.
 treatment, ii. 781-791.
 mucous membrane, ii. 206, 207.
 muscles, ii. 205, 206, 220-225.
 aryteno-epiglottic, ii. 206.
 arytenoid, solitary, ii. 206.
 crico-thyroid, ii. 205.
 lateral crico-arytenoid, ii. 205.
 posterior crico-thyroid, ii. 205.
 superior thyro-arytenoid, ii. 206.
 thyro-arytenoids (true vocal muscles), ii. 205.
 thyro-epiglottic, ii. 206.
 neoplasms of, ii. 751-781.
 adenomata, ii. 758, 759.
 angiomata, ii. 759-761.
 cystomata, ii. 759.
 enchondromata, ii. 761, 762.
 fibro-cellular growths, ii. 757, 758.
 fibromata, ii. 756, 757.
 innocent neoplasms, ii. 751-767.
 lipomata, ii. 761.
 mucocoeles, ii. 759.
 mucous polypi, ii. 757, 758.
 myxomata, ii. 757, 758.
 papillomata, ii. 752-756.
 treatment, ii. 762-767.
 nerves, ii. 208.
 neuroses of, ii. 669-699.
 adductor paralysis, ii. 692, 693.
 anæsthesia, ii. 671, 672.
 bilateral paralysis of the abductors, ii. 688, 691.
 Larynx, neuroses from nasal disease, ii. 114, 115.
 hyperæsthesia, ii. 670, 671.
 laryngeal chorea, ii. 678-683.
 paralysis, ii. 683-694.
 vertigo, ii. 678-683.
 paræsthesia, ii. 672-674.
 paralysis of internal tensors,—thyro-arytenoidei, ii. 693, 694.
 reflex uterine neuroses, ii. 694-698.
 spasm of glottis in adults, ii. 677, 678.
 in children, ii. 674-677.
 unilateral abductor paralysis, ii. 689, 690, 691, 692.
 physiology, ii. 209-211.
 intensity of voice, ii. 210.
 phonation, ii. 209-211.
 pitch of voice, ii. 210.
 quality, or timbre, ii. 210.
 respiration, ii. 209.
 singing, ii. 211.
 speech, ii. 211.
 tension of vocal cords, ii. 210.
 timbre of voice, ii. 210.
 pomum Adami, ii. 193, 199.
 posterior commissure, ii. 204.
 reflex nasal irritation of, ii. 114, 115.
 ring cartilage, ii. 200.
 sesamoid cartilages, posterior, ii. 201.
 sprays for, i. 596.
 supra-glottic division, ii. 204.
 symptoms of disease, i. 591.
 syphilis of, ii. 813-825.
 thyroid cartilage, ii. 199.
 tuberculosis of, ii. 792-812.
 acute tuberculosis, ii. 793.
 bacilli, ii. 792.
 chondritis, ii. 802.
 condylomatous infiltration, meso-arytenoid, ii. 801.
 diagnosis, ii. 805, 806.
 etiology, ii. 803.
 infiltration of epiglottis, ii. 799.
 irregular vascularities, ii. 798, 799.
 local suppuration, ii. 798.
 microscopic inspection of tuberculous infiltration, ii. 800, 801.
 microscopic inspection of ulcerations, ii. 797, 798.
 miliary tubercle, ii. 794.
 pathology, ii. 792.
 perichondritis, ii. 802.
 polypoid excrescences, ii. 802.
 prognosis, ii. 806-808.
 secondary tuberculosis, ii. 794.
 symptomatology, ii. 803-805.
 treatment, ii. 809-812.
 tuberculous infiltration of larynx, ii. 800.
 ulceration, ii. 796.
 of epiglottis, ii. 793.
 of vocal bands, ii. 801.
 veins, ii. 208.
 ventricles, ii. 203.
 vocal bands, ii. 203, 204.
 processes, ii. 200.
Lateral sinus, i. 7.
 phlebitis of, i. 458-460.
 thrombosis of, i. 458-460.
Leber's disease, ii. 153.
Leech, artificial, i. 291.
Leeches in acute otitis media, i. 290.
Leiter coil in acute mastoid inflammation, i. 321.
Leprosy of the larynx, ii. 435-456.
 tuberculine in, ii. 453.
 of the nose, ii. 180, 181.
Leprous stenosis of larynx, ii. 750.
Leukæmia, effect on ear, i. 554.

- Ligamenta canaliculorum (labyrinth), i. 69.
 Ligamentum spirale cochleæ, i. 71.
 Light for examination of nose and throat, i. 577.
 Limbus laminae spiralis, i. 70.
 Lincoln, Rufus P., M.D., on the pharynx and larynx in the exanthemata and other febrile affections, ii. 622-669.
 Linea temporalis (temporal bone), i. 3.
 Lingual hemorrhoids, i. 589.
 Lipoma of auricle, i. 158.
 Lipomata of larynx, ii. 761.
 Lobule (auricle), i. 33.
 anomalies of, i. 126.
 thickening of, i. 151.
 Local therapeutics, nose, naso-pharynx, and larynx, i. 593-611.
 caustics, i. 607, 608.
 dilators, metallic, i. 609.
 galvanic current, i. 608.
 galvano-cautery, i. 608.
 inhalations, i. 605-607.
 insufflators, i. 599-602.
 medicated bougies, i. 608, 609.
 metallic sounds, i. 609.
 pharyngeal douche, i. 599.
 pigments, i. 602-605.
 syringes, i. 598, 599.
 tamponing posterior nares, i. 609-610.
 tampons, medicated, i. 609.
 Lucilia hominivora eggs in nose, i. 738, 772, 773.
 Lupous stenosis of larynx, ii. 747-750.
 Lupus of the auricle, i. 141-145.
 of the larynx, ii. 412-435.
 tubercule in, ii. 430, 431.
 of the nasal cavities, ii. 24-26.
 of the nose, i. 695-702; ii. 181-184.
 definition, i. 695, 697.
 diagnosis, i. 699, 700.
 etiology, i. 697.
 pathology, i. 697.
 prognosis, i. 698, 699.
 symptoms, i. 697, 698.
 treatment, i. 700-702.
 Luschka, tonsil of, ii. 195.
 Lymphatics of nose, i. 568.
- M.**
- MacCoy, Alexander W., M.D., on anatomy and physiology of the nose and naso-pharynx, i. 560-576.
 pharynx and larynx, ii. 192-211.
 Mackenzie, John Noland, M.D., on cirrhotic (atrophic) rhinitis, i. 663-695.
 Major, George W., B.A., M.D., on lupus, tuberculosis, syphilis, glanders, and diphtheria of the nares and naso-pharynx, i. 695-729.
 Malarial diseases, effects on middle ear, i. 376-381.
 Malformations of the ear, i. 124-133.
 Malignant disease from chronic purulent otitis media, i. 463, 464.
 growths of larynx, ii. 767-781.
 neoplasms, nasal cavities, ii. 19, 20.
 otitis externa, i. 215-217.
 Malleus, i. 19.
 development, i. 26.
 fracture of, i. 266, 267.
 ligaments, i. 54, 55.
 malleo-incudal folds, i. 56.
 mucous folds of, i. 55.
 physiology, i. 85.
 posterior ligament of, i. 49, 50.
 processus gracilis, i. 29.
 Mastoid, anatomy, surgical, i. 481-486.
 antrum, i. 5, 27.
 folds, i. 57.
 cells, i. 6, 485.
 development, i. 32.
 disease in acute purulent otitis, i. 310, 312, 321.
 inflammation, i. 481-516.
 cholesteatoma, i. 504, 505.
 complications of, i. 510-512.
 epithelial plug in, i. 503.
 hyperostatic process, i. 503.
 instruments for operation, i. 506, 507.
 limited necrosis, i. 503.
 operative treatment, i. 506-512.
 primary, i. 486-489.
 cases, i. 487-489.
 sclerosis, i. 504.
 secondary, i. 486-489.
 cases, i. 492-501.
 vaso-motor influences, i. 501, 502.
 operation, i. 506-512.
 cases, i. 512-516.
 hemorrhage in, i. 508.
 various stages in, i. 510.
 portion, temporal bone, i. 5, 481-486.
 inner surface, i. 7.
 jugular fossa, i. 8.
 lateral sulcus, i. 7.
 mucous membrane, i. 51.
 pistol-shot wound of, i. 259.
 process, i. 31, 32.
 sigmoid fossa, i. 7.
 sinus, i. 7.
 Mastoideo-squamous suture, i. 27.
 Maxillary sinus, i. 564.
 diseases of, i. 743-755.
 empyema of, i. 744-755.
 mucocoele, i. 743, 744.
 Maximal phonometer (Lucae), i. 96.
 Meatus, external auditory, i. 29.
 internal auditory, i. 11.
 spina, i. 2.
 Median ligament, larynx, ii. 201.
 Membrana basilaris, i. 72-73.
 flaccida, perforations of, i. 434-436.
 tectoria cochleæ, i. 75.
 tympani, i. 43.
 acute inflammation, i. 271.
 angioma of, i. 268, 269.
 annulus tendinosus, i. 47.
 tympanicus, i. 28, 29.
 arteries, i. 47, 48.
 atrophy of, in chronic aural catarrh, i. 342.
 chorda tympani, i. 48.
 chronic catarrh of middle ear, i. 341-343.
 inflammation, i. 272, 273.
 epithelial growths on, i. 267.
 fibromata of, i. 268.
 folds, i. 45.
 fracture at base of skull, i. 258.
 granulations, i. 268.
 hæmatoma, i. 270.
 hemorrhage, i. 270.
 hyperæmia, i. 270.
 injuries of, i. 255-267.
 inspection of, in chronic aural catarrh, i. 356-358.
 layers, i. 45, 46.
 lymphatics, i. 48.
 membrana flaccida, i. 45.
 propria, i. 46, 47.
 miscellaneous conditions of, i. 271.
 myxoma of, i. 268.
 nerves, i. 48.

- Membrana tympani**, perforation, detection of, i. 315.
 physiology, i. 85.
 pockets or pouches, i. 49.
 polypi, i. 268, 269.
 position of ruptures, i. 257.
 Prussak's chamber, i. 50.
 fibres, i. 45.
 space, i. 45.
 retraction of, in chronic catarrh of middle ear, i. 342.
 rupture of, i. 257, 262.
 secundaria, i. 17.
 shape, i. 44.
 Shrapnell's membrane, i. 45.
 size, i. 43.
 thickening of, in chronic catarrh of the middle ear, i. 342.
 topographical relations to interior tympanic wall, i. 50, 51.
 topography of outer surface, i. 45.
 tubercles, i. 268.
 umbo, i. 44.
 veins, i. 48.
 villi, i. 47.
 Von Trötsch's corpuscles, i. 47.
 warts, i. 267.
- Meningitis**, chronic purulent otitis media, i. 460-462.
 effect on ear, i. 554.
 epidemic cerebro-spinal, effect on ear, i. 556.
- Mental diseases** from nasal disease, ii. 136.
- Metastasis** in chronic purulent otitis media, i. 462.
- Microtia**, i. 126-128.
 and polyotia, i. 129.
- Middle ear**, anatomy, i. 42-65.
 chronic catarrh of, i. 323-372.
 dental diseases, effects on, i. 396-401.
 gouty and rheumatic diathesis, effects on, i. 393-396.
 malarial diseases, effects on, i. 376-381.
 membrana tympani, i. 42.
 migraine, effect on, i. 556.
 objective noises in, i. 401-408.
 renal diseases, effects on, i. 373-376.
 syphilis of, i. 381.
 acquired, effects on, i. 381-388.
 hereditary, effects on, i. 388-393.
- Migraine** from nasal disease, ii. 131-133.
 reflex nasal, ii. 131-133.
- Mirrors**, rhinoscopic, i. 583.
- Modifications of hearing** in chronic aural catarrh, i. 347.
- Modiolus**, *see* Cochlea, i. 24.
- Morbid growths**, intra-cranial, effect on ear, i. 555.
- Morgagni**, ventricles of, ii. 203.
- Mouth**, reflex nasal irritation, ii. 112-114.
- Mouth-breathing**, i. 587.
- Mucocoele** of ethmoidal sinuses, i. 762.
 frontal sinuses, i. 767, 768.
 larynx, ii. 759.
 maxillary sinuses, i. 743, 744.
- Mumps**, metastasis of, to internal ear, i. 528.
- Muscles**, constrictor, of pharynx, ii. 195, 196.
 of auricle, physiology, i. 83.
- Music**, history of, ii. 212, 213.
- "Musical ear,"** ii. 214.
 tones, production by larynx, ii. 225, 239.
- Mutes**, deaf, acoustic aid and aural hygiene, i. 537-546.
 partial, acoustic aid and aural hygiene, i. 537-546.
- Myringitis**, acute, i. 271.
 chronic, i. 272, 273.
- Myxoidedema**, epidemic, i. 626-631.
- Myxoidedema**, definition, i. 626, 627.
 symptoms, i. 627-630.
 treatment, i. 630, 631.
- Myxomata**, larynx, ii. 757, 758.
 nasal, ii. 58.
- Myxomatous degeneration** in chronic hypertrophic rhinitis, i. 635.
 tissue in nose, i. 644.
 physiology, i. 89.
- N.
- Nævus** of the nose, ii. 184.
- Nancrede**, Charles B., M.D., on the surgical treatment of croup and diphtheria, ii. 390-411.
- Nares**, posterior, plugging in epistaxis, i. 741.
 tamponing, i. 609, 610.
- Nasal adenomata**, treatment, i. 644.
 atresia, congenital, i. 65.
 caries, surgical procedure, ii. 64.
 cauter, effect on nasal duct, ii. 164.
 cavities, morbid growths, ii. 1-37.
 adenoma, ii. 13.
 angioma, ii. 16.
 bony occlusion, ii. 31, 38.
 chondromata, ii. 16-18.
 cystic polypi, ii. 14.
 deformities, ii. 37, 38.
 deviation of septum, ii. 37.
 ecchondrosis, ii. 29, 30.
 erectile tissue, ii. 5, 6.
 tumors, ii. 15, 16.
 etiology of morbid growths, ii. 4-8.
 exostosis, ii. 31, 32.
 fibroids, ii. 12, 13.
 foreign bodies, ii. 32-35.
 gummata, ii. 21-23.
 history of tumors, ii. 2-4.
 hyperplasias, ii. 26-29.
 hypertrophies, ii. 27-29.
 lupus, ii. 24-26.
 malignant neoplasms, ii. 19, 20.
 mucous polypi, ii. 9-12.
 necrosed bone, ii. 36.
 nerve-supply, ii. 8.
 osteomata, ii. 18, 19.
 papillomata, ii. 14, 15.
 physiology, ii. 6-8.
 polypi, ii. 8-14.
 polypoid excrescences, ii. 9.
 rhinoliths, ii. 35-37.
 secretion, ii. 7.
 sense of smell, ii. 8.
 soft papilloma, ii. 14.
 split septum, ii. 38.
 synechiæ, ii. 30, 31.
 syphilis, ii. 20-23.
 tuberculosis, ii. 23, 24.
- diphtheria**, secondary, i. 724-725.
 treatment, i. 725-728.
- disease** caused by disease of the eye, ii. 171-173.
 cold in head from ametropia, ii. 171.
 nose-bleed from ametropia, ii. 171.
 ozæna, relation to epiphora, ii. 172.
 in hay-fever, ii. 70-73.
 reflex, from ocular maladies, ii. 149-172.
- douche**, i. 598.
 cause of acute inflammation of the middle ear, i. 274.
- duct**, effect of unskilful use of cauter, ii. 164.

Nasal myxoma, treatment, i. 644.
 polypi, treatment, i. 644.
 reflex neuroses, ii. 97-148.
 speculum, bivalve, i. 579.
 self-retaining, i. 579.

Naso-pharyngeal diphtheria, treatment, i. 719-728.

Naso-pharynx, anatomy of, i. 571-575.
 blood-vessels, i. 574, 575.
 Eustachian tube, i. 573.
 fossa of Rosenmüller, i. 573.
 muscles of, i. 574.
 physiology of, i. 575.
 tonsil of Luschka, i. 573.
 walls of, i. 572, 573.

diseases of, in acute catarrhal otitis media, i. 282-288.
 diphtheria of, i. 719-728.
 discharge from, i. 587.
 examination of, i. 582-588.
 facial expression, i. 587.
 local therapeutics, i. 593-611.
 palpation of, i. 586.
 proof of a clear, i. 587.
 symptoms of disease of, i. 587, 588.
 syphilis of, i. 709-715.
 voice, i. 587.

Necrosed bone, nasal cavities, ii. 36.

Necrosis, limited, in mastoid inflammation, i. 503.
 of adjacent structures, in chronic purulent otitis media, i. 449-456.

Neoplasms, innocent, of larynx, ii. 751-767.
 nasal, benign, ii. 58-63.
 malignant, ii. 63, 64.
 myxomata, ii. 58.
 surgery of, ii. 58-64.

Nephritis, effect on ear, i. 557.

Nerve, Arnold's, i. 81.
 auditory, i. 77, 78.
 facial, i. 80.
 Jacobson's, i. 81.
 olfactory, i. 568, 570.
 pneumogastric, branch to ear, i. 81.
 tympanic plexus, i. 82.
 Vidian, i. 81, 82.
 Wrisberg's, i. 80.

Nerves in and about tympanum, i. 79-82.
 of muscles of auricle, i. 36.

Nervous cough, ii. 109-112.
 system, disorders of, effect on ear, i. 554.

Nervus musculi stapedii, i. 16.

Neuralgia, reflex nasal, ii. 131-133.
 supra-orbital, from nasal disease, ii. 155.

Neurasthenia, in nasal disease, ii. 140-142.

Neuritis, optic, in ear-diseases, i. 549-551.
 retro-bulbar, from nasal disease, ii. 156.

Neuroses, nasal reflex, historical, ii. 101.
 of larynx, ii. 669-699.
 of nose, aprosexia, ii. 135, 136.
 asthma, ii. 102.
 chorea, ii. 133-135.
 cough, ii. 109-112.
 diagnosis, ii. 144.
 epilepsy, ii. 135, 136.
 etiology, general, ii. 142.
 eye-disease, ii. 128-131.
 headache, ii. 131-133.
 heart-disease, ii. 137.
 hyperæsthesia, ii. 107, 108.
 hysteria in, ii. 140-142.
 Graves's disease in, ii. 137, 138.
 mental diseases, ii. 136.
 migraine, ii. 131-133.
 neuralgia, ii. 131-133.
 neurasthenia, ii. 140-142.
 prognosis, ii. 144, 145.
 reflexes in the ear, ii. 128.

Neuroses of nose, reflexes in the eye, ii. 128-131.
 outside the respiratory tract, ii. 127.
 respiratory, ii. 106-125.
 sexual organs, ii. 140.
 skin-diseases of nose and face, ii. 138-140.
 sternutation, ii. 108, 109.
 stomach, ii. 136.
 tic douloureux, ii. 131-133.
 treatment, ii. 145-148.
 vertigo, ii. 135, 136.

of nose and naso-pharynx, ii. 90-148.
 asthma, ii. 127.
 olfaction, ii. 90-97.
 reflex, ii. 97-148.

of olfaction, ii. 90-97.
 anosmia, ii. 92-97.
 diagnosis, ii. 95.
 prognosis, ii. 94.
 symptoms, ii. 94.
 treatment, ii. 95-97.

anosmia essentialis, ii. 92.
 intra-cranialis, ii. 93.

anosphresia, ii. 92-97.
 hyperosmia, ii. 91.
 hyposphresia, ii. 91.
 parosmia, ii. 90, 91.
 parosphresia, ii. 90, 91.

reflex nasal, ii. 97-148.
 asthenopia, ii. 129.
 asthma, ii. 115-127.
 chorea, ii. 133-135.
 classification, ii. 106.
 diagnosis, ii. 144.
 epilepsy, ii. 135, 136.
 etiology, ii. 142-144.
 Graves's disease, ii. 137, 138.
 headaches, ii. 131-133.
 heart, ii. 137.
 historical, ii. 101-106.
 hysteria, ii. 140-142.
 lachrymation, ii. 128.
 laryngismus stridulus, ii. 114.
 larynx, ii. 114, 115.
 migraine, ii. 131-133.
 mouth, ii. 112-114.
 neuralgia, ii. 131-133.
 neurasthenia, ii. 140-142.
 oedema of eyelids, ii. 128.
 pharynx, ii. 112-114.
 physiology, ii. 97-101.
 prognosis, ii. 144.
 respiratory, ii. 106, 107.
 sexual organs, ii. 140.
 skin-diseases of face, ii. 138, 139.
 of nose, ii. 138, 139.
 sternutation, ii. 108, 109.
 stomach, ii. 136, 137.
 tic douloureux, ii. 131-133.
 treatment, ii. 145-148.

unclassified, effect on ear, i. 557.

Neurotic habit in hay-fever, ii. 70.

Niche, or attic, i. 53.

Noises, snapping, from the ear, i. 401-408.

Nose, anatomy of, i. 560-570.
 ducts, i. 565.
 erectile tissue, i. 566.
 external nose, i. 560-562.
 fossæ, i. 562-568.
 glands, i. 566.
 lymphatics, i. 568.
 mucous membrane of, i. 565.
 nasal fossæ, i. 562-568.
 nerves, i. 567, 568.
 olfactory cells, i. 568.
 nerve, i. 568, 570.

Nose, anatomy of, vascularity, i. 567.
congenital or developmental anomalies of
the, or of adjacent structures, affecting
the eye, ii. 152-154.
diseases of:

accessory sinuses of, i. 743-775.
animate foreign bodies in, i. 738.
asthma from, i. 588.
cocaine in examination, i. 580.
cough from, i. 588.
diphtheria, i. 719-728.
discharge, i. 587.
eggs of *Comptosia macellaria* (*Lucilia hominivora*) in, i. 772-774.
epistaxis, i. 588.
examination of, i. 576-582.
fetus in, i. 588.
foreign bodies in, i. 729-738.
glanders, i. 715-719.
headache in, i. 588.
Lucilia hominivora in, i. 738.
lupus, i. 695-702.
mouth-breathing in, i. 587.
nightmare from, i. 588.
nose-bleed, i. 738-742.
ocular symptoms from, i. 588.
ozæna, i. 663-694.
rhinitis, acute, i. 611-623.
chronic hypertrophic, i. 632-662.
rhinoliths, i. 731-738.
sneezing, i. 588.
sprays for, i. 595.
symptoms of, i. 587, 588.
syphilis, i. 705-715.
therapeutics, local, in, i. 593-611.
tuberculosis, i. 702-705.
fracture of, surgical procedure, ii. 65.
hæmatoma of, ii. 65.
pathological conditions of, secondarily af-
fecting the eye, ii. 152.
physiology of, i. 568-571.
in phonation, i. 570.
in respiration, i. 570.
relation to auditory apparatus, i. 571.
skin-diseases of, ii. 173-191.
acne, ii. 173-175.
eczema, ii. 175-177.
epithelioma, ii. 177-179.
eruptions from bromide and iodide of
potassium, ii. 191.
erysipelas, ii. 179, 180.
erythema, ii. 180.
leprosy, ii. 180, 181.
lupus, ii. 181-184.
nævus, ii. 184.
nasal reflex, ii. 138, 139.
psoriasis, ii. 184.
rhino-scleroma, ii. 185.
rosacea, ii. 185, 186.
seborrhoea, ii. 187.
sycoosis, ii. 187.
syphilis, ii. 187-191.
telangiectasis, ii. 191.
surgery of, ii. 39-65.

Nose-bleed caused by ametropia, ii. 171.
Nuel's space, i. 74.
Nystagmus in ear-diseases, i. 552.

O.

Occipital bone, caries of, i. 454.
Occlusion, bony, nasal cavities, ii. 31, 38.
Edema of eyelids, reflex nasal, ii. 128.
Oesophagismus, ii. 113.
Oesophagus, foreign bodies in, ii. 533-570.
extraction, ii. 562-570.
incision, ii. 566-570.

Oesophagus, foreign bodies in, propulsion, ii. 564-566.

Olfaction, neuroses of, ii. 90-97.

Olfactory nerve, i. 568.
region, i. 570.

Oliver, Charles A., A.M., M.D., on ocular lesions
in aural diseases, and coincident ocular and
aural disorders in systemic disturbances, i.
547-560.

Ophthalmia, gonorrhoeal, conveyed from the nose,
ii. 158, 159.

neonatorum conveyed from the nose, ii. 158.

Opisthotic centre, i. 30.

Optic atrophy, congenital, from nasal disease, ii.
153.

from nasal disease, ii. 158.

disk, atrophy of, from ethmoidal and sphenoidal sinuses, ii. 154.

nerve, compression of, from tumors of sphenoidal and ethmoidal sinuses, ii. 157.
neuritis in chronic purulent otitis media, i.
462.

ear-diseases, i. 549-551.

sinus-thrombosis, i. 459.

Orbital abscess from coryza, ii. 156.

from empyema of antrum of Highmore,
ii. 155.

Oro-pharynx, i. 572; ii. 192.

Os epitympanicum, i. 27.

Os planum, necrosis of, in nasal disease, ii. 155.

Ossicles, auditory, i. 19-22.

articulation, i. 51-54.

balancing, i. 53.

bone lamella, i. 53.

caries of, i. 451.

chronic aural catarrh, i. 343.

counterbalance, i. 53.

folds, i. 57.

incudo-stapedial articulation, i. 52.

ligaments, i. 54, 55.

medullary cavity, long axis, i. 53.

motions, i. 85-88.

physiology, i. 88-90.

Ossification of auricle, i. 152.

Osteoma of ethmoidal sinuses, i. 763.

Osteomata, nasal cavities, ii. 18, 19.

Otalgia in chronic aural catarrh, i. 351.

Othæmatoma of auricle, i. 153-156.

Otic ganglion, i. 79.

Otitis externa acuta, i. 166-215.

chronica, i. 215-217.

circumscripta, i. 166-172.

crouposa, i. 181-186.

diffusa, i. 172-177.

maligna, i. 215-217.

syphilitica, i. 186-190.

diphtheritica, i. 181-186.

dissecans, i. 177-181.

parasitica, i. 190-215.

media acuta, i. 273-322.

from snuffing water into nose, i.
278.

paracentesis, i. 280, 281.

scarification of membrana tympani,
i. 292.

catarrhalis acuta, i. 273-294.

chronica, i. 323-372.

purulenta acuta, i. 300-322.

chronica, i. 409-444.

serosa, i. 295-296.

Otoliths, i. 68.

Otorrhoea, chronic, i. 409-444.

Otoscope, Toynbee's, i. 111.

Ozæna, see Rhinitis atrophica, i. 663-694.

cause of eye-diseases, ii. 159.

corneal ulceration from, ii. 161.

epiphora from, ii. 163, 164.

Ozæna, origin, i. 677, 678.
pathology, i. 666-680.
relation to epiphora, ii. 172.

P.

Pachydermia laryngis, ii. 473.

Palate, hard, ii. 192, 193.

soft, ii. 193.

muscles of, ii. 193.

Palate-retractor, White's, i. 584.

Palpation of naso-pharynx, i. 586.

Pannus with disease of lower turbinates, ii. 160.

Panophthalmitis from empyema of antrum of Highmore, ii. 155.

Panotitis, effects on internal ear, i. 528-530.

Papilla acustica, i. 73.

Papillitis from ozæna, ii. 159.

Papilloma of auricle, i. 162.

soft, nasal cavities, ii. 14.

Papillomata, larynx, ii. 752-756.

nasal cavities, ii. 14, 15.

Paracentesis membranæ tympani, i. 280, 281, 299.

in chronic aural catarrh, i. 367.

in serous otitis media, i. 296.

Paracusis duplicata, i. 347.

Willisii, i. 347.

Paræsthesia of larynx, ii. 672-674.

Paralysis of cranial nerves in ear-disease, i. 551.

facial, chronic purulent otitis media, i. 451, 453.

fifth, sixth, and seventh nerves, in chronic suppuration of middle ear, i. 454.

Parasitic otitis externa, i. 190-215.

Parietal bone, caries of, i. 454.

Parosmia, ii. 90, 91.

Parosphresia, ii. 90, 91.

Parotid gland, i. 33.

Pars vestibuli (cæcum vestibuli), i. 72.

Pathology of hay-fever, ii. 73-75.

Pelvis ovalis (tympanum), i. 16.

rotunda (tympanum), i. 17.

Pemphigus of auricle, i. 138, 139.

Perforation of membrana tympani, detection of (Pins's method), i. 315.

Perichondritis of auricle, i. 148-150.

laryngis, ii. 482.

chronica, ii. 473.

Perilymph, internal ear, i. 66.

Perilymphatic spaces, i. 66.

Peritonsillar abscess, ii. 260-265.

Peritonsillitis, ii. 260-265.

Pertussis, effect on ear, i. 559.

Petro-mastoid bone, i. 30, 31.

epiotic centre, i. 30.

fossa subarcuata, i. 30.

opisthotic centre, i. 30.

protic centre, i. 30.

pteroitic centre, i. 30.

Petro-squamosal fissure, i. 12.

Petrosal ganglion, i. 81.

Petrous bone, i. 8-13.

adenoma, i. 464.

anterior border, i. 13.

aquæductus cochleæ, i. 13.

vestibuli, i. 11.

squeduct of Fallopius, i. 11.

area cribrosa media, i. 11.

superior, i. 11.

canalis musculo-tubarius, i. 13.

tympanicus, i. 11.

carotid canal, i. 10.

foramen, i. 10.

crista falciformis, i. 11.

foramen centrale cochleæ, i. 11.

lacerum medium, i. 11, 13.

singulare, i. 11.

Petrous bone, fossa subarcuata, i. 12.

Gasserian ganglion, i. 12, 32.

gyrus fusiformis, i. 32.

hippocampi, i. 33.

inferior, i. 32.

hiatus Fallopii, i. 11, 12.

inferior border, i. 13.

petrosal sinus, i. 13.

surface, i. 10.

internal auditory meatus, i. 11.

jugular facet, i. 10.

fossa, i. 10.

lamina cribrosa, i. 11.

posterior border, i. 13.

surface, i. 11.

processus cochleariformis, i. 13.

septum tubæ, i. 13.

sinuses connected with, i. 82.

squamous surface, i. 32.

stylo-mastoid foramen, i. 10.

styloid process, i. 10.

superior border, i. 12.

surface, i. 32.

tegmen mastoideum, i. 12.

tympani, i. 12.

tractus spiralis foraminulentus, i. 11.

ganglion, i. 81.

Pharyngeal tonsil, anatomy, i. 573, 574.

enlargement, i. 649, 650.

Pharyngitis abscedens, ii. 260-265.

acute catarrhal, ii. 250-259.

etiology, ii. 250, 257.

pathological anatomy, ii. 254.

prophylaxis, ii. 228, 259.

symptoms, ii. 251-254.

synonymes, ii. 250.

treatment, ii. 254-258.

catarrhal, subacute, ii. 259, 260.

chronic, ii. 284-304.

follicular, ii. 284-291.

diagnosis, ii. 287, 288.

etiology, ii. 285.

prognosis, ii. 288.

retro-pharyngeal abscess in, ii. 301.

symptoms, ii. 286, 287.

treatment, ii. 288, 291.

erysipelatosus, ii. 268.

gangrenous, ii. 268.

herpeticæ, ii. 270, 271.

phlegmonous, ii. 260-265.

acute infectious, ii. 265, 266.

rheumatic, ii. 272.

syphilitic, ii. 292-298.

tubercular, ii. 298-301.

ulcerosa, ii. 266-268.

Pharyngo-laryngeal sinus, ii. 195.

Pharynx, i. 571, 572.

acute inflammation of, ii. 250-259.

anatomy and physiology of, ii. 192-211.

arteries, ii. 196.

azygos uvulæ, ii. 193.

constrictor muscles, ii. 195, 196.

epiglottis, ii. 195.

fauces, ii. 192.

hard palate, ii. 192, 193.

isthmus of fauces, ii. 192.

laryngo-pharynx, ii. 195.

lymphatics, ii. 197.

motor nerves, ii. 197.

mucous membrane, ii. 196.

oro-pharynx, ii. 192.

pharyngo-laryngeal sinus, ii. 195.

plica salpingo-pharyngea, ii. 193, 194.

pyramidal sinus, ii. 195.

sensory nerves, ii. 197.

soft palate, ii. 193.

muscles, ii. 193.

Pharynx, anatomy, tonsil of Luschka, ii. 195.
 tonsils, ii. 194, 195.
 uvula, ii. 193.
 veins, ii. 196, 197.
 velum, ii. 193.
deformities, ii. 709-719.
 pouches, ii. 717-719.
 stenosis, congenital, ii. 710, 711.
 secondary, ii. 711, 717.
divisions of, i. 572.
effects of nasal disease on, ii. 112.
erysipelas of, ii. 268.
foreign bodies in, ii. 533-570.
 diagnosis, ii. 551-555.
 etiology, ii. 533-539.
 migration, ii. 544, 545.
 prognosis, ii. 555, 556.
 resultant diseased conditions, ii. 545-551.
 abscess, ii. 545, 546.
 caries of vertebræ, ii. 549, 550.
 œdema of larynx, ii. 545.
 penetration of pericardium and heart, ii. 549.
 penetration of pleural cavity, lungs, and bronchi, ii. 549.
 perforation of blood-vessels, ii. 547-549.
 rupture of œsophagus, ii. 550, 551.
 stricture, ii. 546.
 ulceration, ii. 546.
symptoms, ii. 539-543.
 imaginary, ii. 542, 543.
 immediate, ii. 539-541.
 remote, ii. 541, 542.
 tolerance, ii. 543, 544.
 treatment, ii. 556-562.
herpes of, ii. 270, 271.
malignant disease, ii. 295.
morbid growths, ii. 719-734.
 innocent growths, ii. 720-727.
 angiomata, ii. 722, 723.
 cysts, ii. 726.
 fibroma, ii. 721.
 lipomata, ii. 721, 722.
 lymphadenomata, ii. 720, 721.
 lymphoma, ii. 720, 721.
 myxomata, ii. 721.
 papillomata, ii. 724-726.
 teratomata, ii. 726.
malignant growths, ii. 727-734.
 epitheliomata (carcinomata), ii. 731-734.
 lympho-sarcomata, ii. 730, 731.
 myxo-sarcomata, ii. 729, 730.
 sarcoma, round-cell, ii. 727, 728.
 spindle-cell, ii. 728, 729.
 sarcomata, ii. 727-731.
primary growths, ii. 719.
neuroses of, ii. 699-704.
 motion, ii. 700-704.
 sensation, ii. 699, 700.
physiology of, i. 575; ii. 197-211.
 deglutition, ii. 197-198.
 reflex nasal irritation of, ii. 112-114.
 sprays for, i. 595.
Pharynx and larynx in fevers, ii. 622-668.
 acute glanders, ii. 668.
 gout, ii. 667.
 rheumatism, ii. 665-667.
 cerebro-spinal fever, ii. 661.
 dengue, ii. 663.
 erysipelas, ii. 643-650.
 infectious anginas, ii. 650-653.
 influenza, ii. 663-665.

Pharynx and larynx in fevers, malarial fever, ii. 662.
 measles, ii. 638-641.
 mumps, ii. 642, 643.
 relapsing fever, ii. 660, 661.
 rötheln, ii. 641, 642.
 scarlatina, ii. 622-633.
 typhoid fever, ii. 653-658.
 typho-malarial fever, ii. 662.
 typhus fever, ii. 658-660.
 varicella, ii. 638.
 variola, ii. 633-637.
 varioid, ii. 637.
 yellow fever, ii. 661.
Phlebitis of sinuses and jugulars in ear-disease, i. 458-460.
Phlegmonous inflammation of antrum, i. 755.
Phlyctenular disease from rhinitis, ii. 160.
Phonation, i. 570; ii. 225-239.
Phonograph, test of hearing, i. 98.
Photophobia from swollen turbinates, ii. 169.
Physiology, ampullæ of semicircular canals, i. 90.
 cochlea, i. 91, 92.
 ear, i. 83-92.
 Eustachian tube, i. 87, 88.
 external ear, i. 83-85.
 incus, i. 85, 86.
 malleus, i. 85.
 membrana tympani, i. 85.
 secundaria, i. 89.
 muscles of auricle, i. 83.
 nasal respiration, i. 569.
 nose, i. 568-571.
 ossicles, i. 85, 88, 90.
 pharynx, i. 575.
 pinna, i. 83.
 semicircular canals, i. 90.
 stapedius muscle, i. 87.
 tensor tympani, i. 87.
Pigments for nose and throat, i. 602-605.
Pinna, i. 33.
 muscles, i. 35.
 physiology, i. 83.
Pitch of voice, ii. 216.
Plexus, tympanic, i. 82.
Plica salpingo-pharyngea, ii. 193, 194.
Politzer's inflation-bag, i. 113.
 inflation of tympana, i. 112-114.
Pollen as cause of hay-fever, ii. 68, 69.
Polyotia, i. 128, 129.
Polypi, aural, treatment of, i. 269, 270, 423-427.
 chronic purulency of middle ear, i. 420-423.
 cystic, nasal cavities, ii. 14.
 ethmoidal sinuses, i. 763.
 mucous, of larynx, ii. 757, 758.
 nasal, ii. 9-12.
 nasal, i. 644.
 nasal cavities, ii. 8-14.
Polypoid excrescences, nasal cavities, ii. 9.
Porcher, W. Peyre, M.D., on neuroses of the larynx and of the pharynx, and dysphagia, ii. 669-709.
Post-glenoid process, i. 3.
Powders, antiseptic, in chronic purulent otorrhœa, i. 420.
Presbyopia from nasal disease, ii. 153.
Pre-tracheal space, surgical anatomy, ii. 396-399.
Probe, aural, i. 110.
Processus caudatus, auricle, i. 34.
 cochleariformis, i. 13, 19.
 squamo-mastoideus, i. 27.
 styloideus, i. 32.
Promontory (tympanum), i. 16.
Proötic centre, i. 30.
Prophylaxis of acute rhinitis, i. 615.

Prussak's chamber, i. 20, 50.
fibres, i. 45.
space, i. 45.

Pseudocousma, i. 347.

Pseudo-leukæmia, Hodgkin's disease, effect on the ear, i. 554.

Psoriasis of the nose, ii. 184.

Psychic influence in hay-fever, ii. 72.

Pterotic centre, i. 30.

Purulent otitis media, acute, i. 300-322.

Pyæmia in chronic suppuration of middle ear, i. 462.

Pyramid, i. 12.

Pyramidal sinus, larynx, ii. 195.

Q.

Quality of voice, ii. 216.

Quinsy, ii. 260-265.

R.

Raucedo syphilitica, ii. 815.

Recessus anterior, i. 17.

Cotignil, i. 67.

posterior, i. 17.

tympanicus, i. 53.

Reissner's membrane, i. 71.

Relapsing fever, ear-disease from, i. 558.

Renal diseases, effects on middle ear, i. 373-376.

Resonators, natural, of voice, ii. 235-237.

Respiration, ii. 209.

Respiratory reflex neuroses, ii. 106, 107.

Retractor, palate, White's, i. 584.

Retrahens aurem, i. 35.

Retina, congestion of, from nasal disease, ii. 169.

Rheumatic sore throat, ii. 272.

Rheumatism, effects on middle ear, i. 393-396.

Rhigolene in nasal surgery, ii. 40.

Rhinitis acuta, i. 611-623.

bathing, i. 617-619.

clothing, i. 616, 617.

diagnosis, i. 614, 615.

etiology, i. 611, 612.

pathology, i. 612.

prognosis, i. 615.

prophylaxis, i. 615.

symptomatology, i. 612-614.

treatment, i. 619-623.

atrophica, i. 663-694.

complications, i. 684-686.

diagnosis, i. 681-684.

etiology, i. 664-666.

obliteration of erectile spaces, i. 670, 671.

origin of, i. 677, 678.

pathology, i. 666-680.

periods in, i. 665, 666.

prognosis, i. 686, 687.

sequels, i. 684-686.

symptoms, i. 680, 681.

synonymes, i. 663.

treatment, i. 687-694.

chronic hypertrophic, i. 632-662.

adenoid tissue of vault, i. 648.

adenomata, i. 644.

classification of stages of inflammation, i. 665, 666.

constitutional treatment, i. 648.

Dobell's solution, i. 646.

etiology, i. 632, 633.

Eustachian salpingitis, i. 658, 659-662.

hypertrophies, i. 640-644.

hypertrophy of pharyngeal tonsil, i. 648-655.

Rhinitis, chronic hypertrophic, inflammatory affections of Eustachian tube, i. 655.

inspection of nose, i. 637.

myxomatous degeneration, i. 644.

nasal polypi, i. 644.

pathological anatomy, i. 633-636.

pharyngeal tonsil, hypertrophy, i. 648-655.

sclerosis, i. 647, 654.

septum, growths on, i. 644.

symptoms, i. 636-638.

treatment, i. 638-648.

varieties of hypertrophy of pharyngeal tonsil, i. 648.

cirrhotica, i. 663-694.

definition, i. 674.

Rhinoliths, i. 731-738; ii. 35-37.

Rhino-scleroma, ii. 185.

Rhinoscope and tongue-depressor (Jarvis's), ii. 44, 45.

Rhinoscopic image, i. 585.

mirror and tongue-depressor combined (Jarvis's), i. 583.

mirrors, i. 583.

Richards, Huntingdon, M.D., on examination of patients; with instruments needed therein, and methods of their employment, i. 99-124.

Rima glottidis, ii. 204.

Ring cartilage, ii. 200.

Ring-knife, Meyer's, i. 285.

Rinne's method, i. 98.

test, chronic aural catarrh, i. 355, 356.

Rivinus, foramen of, i. 256.

notch of, i. 27.

segment of, i. 43.

Roe, John O., M.D., on foreign bodies in the larynx and trachea, and in the pharynx and œsophagus, ii. 500-570.

Rongeur septum-forceps (Jarvis's), ii. 52.

Roof of the tympanum, i. 14.

Rosacea of the nose, ii. 185, 186.

Rosenmüller's fossæ, i. 62, 573.

Rostrum cochleare, i. 16, 19.

S.

Saccule, membranous labyrinth, i. 67.

sinus utricularis, i. 69, 70.

Sacculus laryngis, dislocation, ii. 750, 751.

Santorini, cartilages of, ii. 199, 201, 203.

fissures of, i. 29, 40.

Sarcoma of auricle, i. 164, 165.

ethmoidal cells, i. 763.

middle ear, i. 463, 464.

Sarcomata of larynx, ii. 778-781.

lympho-, of pharynx, ii. 730, 731.

myxo-, of pharynx, ii. 729, 730.

of pharynx, ii. 727-731.

round-cell, of pharynx, ii. 727, 728.

spindle-cell, ii. 728, 729.

Saw in nasal deformities, ii. 48.

Scala media cochleæ, i. 71.

tympani cochleæ, i. 17.

Scarification of membrana tympani, i. 292.

Scarlatina, larynx and pharynx in, ii. 622-633.

Scissor-punch (Jarvis's) in nasal surgery, ii. 52.

Sclerosis of mastoid, i. 504.

nasal tissues, treatment, i. 647.

turbinated bodies, i. 634.

Sclerotic catarrh of middle ear, i. 324.

Screw-worm in frontal sinuses, i. 772-774.

Sea-bathing, effect on ear, i. 274, 277.

Sebaceous tumor of auricle, i. 158, 159.

Seborrhœa of the nose, ii. 187.

Secretion, nasal cavities, ii. 7.

Seiler, Carl, M.D., on influenza and American grippe, or epidemic myxoïdema, i. 624-632.

- Seiler, Carl, M.D., on morbid growths and deformities of the nasal cavities; pathology, etiology, physiology, and differential diagnosis, ii. 1-38.
- Seiss, Ralph W., M.D., on chronic hypertrophic rhinitis, i. 632-663.
- Sella incedis, i. 15, 21, 52.
- Semicircular canals, i. 23.
 ampulla, i. 23.
 crista acustica, i. 69.
 external, 24.
 ligamenta canaliculorum, i. 69.
 membranous, i. 68.
 nystagmus from irritation, i. 552.
 physiology, i. 90.
 posterior, i. 24.
 superior, i. 23.
- Septometer (Jarvis's) in nasal surgery, ii. 50.
- Septum, deviation, nasal cavities, ii. 37.
 nasal, growths upon, i. 644.
 surgery of deformities, ii. 47-58.
 perforation, ii. 65.
 scissor punch (Jarvis's), ii. 52.
 split, nasal cavities, ii. 38.
 tubæ (petrous bone), i. 13, 18.
- Sequester, auditory canal, i. 450, 451.
- Serous otitis media, i. 296.
 paracentesis, i. 296.
- Sesamoid cartilages, ii. 201.
- Sexton, Samuel, M.D., on chronic catarrh of the middle ear: including preventive hygiene, i. 323-373.
- Sexual organs affected in nasal diseases, ii. 140.
 reflex nasal irritation, ii. 140.
- Shrapnell, membrane of, i. 44.
- Shurly, E. L., M.D., on chronic laryngitis, simple and traumatic, ii. 457-499.
- Siegle's aural speculum, i. 110.
- Singing, larynx in, ii. 211.
- Sinus, inferior petrosal, *see* Petrous bone, i. 13.
 lateral, i. 7.
 sigmoid, i. 7.
 tympanicus, i. 17, 30.
 folds, i. 57.
- Sinuses, accessory, of nose, i. 564.
 diseases of, i. 743-775.
 brain, i. 82.
 connected with petrous bone, i. 82.
 ethmoidal, i. 564.
 diseases of, i. 758-763.
 frontal, i. 564.
 diseases of, i. 766-775.
 maxillary, i. 564.
 diseases of, i. 743-758.
 sphenoidal, i. 564.
 diseases of, i. 766-775.
- Sinus-thrombosis, symptoms of, in chronic purulent otitis media, i. 459, 460.
- Skin-diseases of nose and face, reflex from nasal disease, ii. 138-140.
- Smell, sense of, ii. 8.
- Smith, J. Lewis, M.D., on diphtheria, ii. 343-390.
- Snare, Jarvis's, in nasal hypertrophy, ii. 44.
- Sneezing, morbid, ii. 108, 109.
 nasal reflex, ii. 108, 109.
- "Sniffing" water into nose, i. 278.
- Solutions, antiseptic, for cleansing nose, i. 580.
 in chronic purulent otorrhœa, i. 418.
- Sore throat, acute, ii. 250-259.
 aphthous, ii. 270, 271.
 clergyman's, ii. 284-292.
 common membranous, ii. 270, 271.
 gouty, ii. 273.
 granular, ii. 284-292.
 hospital, ii. 284-292.
 rheumatic, ii. 272.
- Sore throat, ulcerated, ii. 266-268.
- Sound, location of, i. 83.
- Spasmodic croup, ii. 334-336.
- Spear, Edmund D., M.D., on diseases of the internal ear: acoustic aid and aural hygiene of the very deaf, partial mutes, and deaf-mutes, i. 517-547.
- Specula, aural, i. 105, 106.
 Boucheron's, i. 106.
 Gruber's, i. 106.
 Politzer's, i. 106.
 Siegle's pneumatic, i. 110.
 Wilde's, i. 105.
- nasal, i. 579.
 bivalve, i. 579.
 Bosworth's, i. 579.
- Speech, larynx in, ii. 211.
 tests of hearing, i. 96-98.
- Sphenoidal sinuses, i. 564.
 disease of, effect on eye, ii. 154.
 diseases, i. 763-766.
 tumors, i. 766.
- Spheno-palatine ganglion, ii. 8.
- Spina tympani anterior, i. 28.
 inferior, i. 28.
 major, i. 15, 28.
 posterior, i. 15, 29.
- Spinal cord, posterior sclerosis, effect on ear, i. 556, 557.
- Spiral canal, cochlea, i. 71.
- Sprays, alkaline, i. 597.
 antiseptic, i. 596.
 astringent, i. 597.
 cleansing, i. 597.
 for nose and throat, i. 593-598.
 medicated, i. 596.
 oleaginous, i. 597.
 sedative, i. 597.
- Squamous portion of temporal bone, i. 27.
- Stacke's operation in cholesteatoma of middle ear and mastoid cavity, i. 448, 449.
- Stammering, ii. 247, 248.
- Stapedius muscle, i. 58.
 mucous fold, i. 56.
 physiology, i. 87.
 tenotomy of, in chronic aural catarrh, i. 368.
- Stapes, i. 21.
 development, i. 27.
 membrana propria, i. 56.
 obturator or annular ligament, i. 52.
 removal, in ear-diseases, i. 461-485.
 cases, i. 470-479.
 chronic catarrh of the middle ear, i. 465-480.
 description of operation, i. 467-469.
 history of operation, i. 465-466.
 pathology in, i. 470.
 results of, i. 479, 480.
- Stellate punch in deformities of septum, ii. 57.
- Stenosis, membranous, of larynx, ii. 486.
 traumatic, of larynx, ii. 743, 744.
- Sternutation, nasal reflex, ii. 108, 109.
- Stirrup, *see* Stapes, i. 21, 22.
- Stomach, diseases of, from nasal disease, ii. 137.
 reflex nasal irritation, ii. 136, 137.
- Strabismus from nasal disease, ii. 153.
- Stria vascularis cochleæ, i. 71.
- Stroboscopic method, i. 86.
- Stuttering, ii. 247, 248.
- Styloid process, i. 10, 32.
- Stylo-mastoid foramen, i. 10, 28.
- Subacute catarrhal otitis media, i. 294-300.
 treatment, i. 297-300.
- Subarachnoid space, labyrinth, i. 66.

- Submaxillary ganglion, i. 80.
 Sulcus ligamenti spiralis, i. 71.
 malleolarius, i. 29.
 spiralis, *see* Cochlea, i. 70.
 tympanicus, i. 15, 28.
 Surgery of nose, ii. 39-65.
 abscess, ii. 65.
 adenoids, ii. 61.
 angiomata, ii. 61, 62.
 antisepsis, ii. 39-41.
 asymmetry of bones, ii. 65.
 benign neoplasms, ii. 58-63.
 cocaine, ii. 40.
 congenital nasal atresia, ii. 65.
 deformities of septum, ii. 47-58.
 écraseur for adenoids, ii. 61, 62.
 fracture of nose, ii. 65.
 general anæsthetics, ii. 40.
 hæmatoma, ii. 40.
 hemorrhage, ii. 40.
 hypertrophy of turbinated tissue, ii. 41-47.
 chemical caustics, ii. 41.
 electric cautery, ii. 42.
 excision methods, ii. 43-47.
 Jarvis's snare, ii. 44.
 nasal écraseur, ii. 44.
 posterior hypertrophies, ii. 45.
 rhinoscope and tape-holders, ii. 45.
 transfixion-needles, ii. 45, 47.
 local anæsthesia, ii. 40.
 malignant neoplasms, ii. 63, 64.
 miscellaneous conditions, ii. 64, 65.
 neoplasms, ii. 58-64.
 rhigolene, ii. 40.
 septum-deformities, ii. 50-58.
 écraseur, ii. 50, 51.
 forceps, ii. 51-53.
 hæmostatic clamp (Jarvis's), ii. 51.
 knife, ii. 48.
 nasal clamp-splint, ii. 57.
 perforation, ii. 65.
 rongeur septum-forceps (Jarvis's), ii. 52.
 saw, ii. 48.
 scissor-punch, ii. 52.
 septometer (Jarvis's), ii. 50.
 stellate punch procedure, ii. 57.
 surgical drill in nasal deformities, ii. 53-56.
 Sycosis of the nose, ii. 187.
 Synechiæ, nasal cavities, ii. 30, 31.
 Syphilis, acquired, effects on middle ear, i. 381-388.
 as cause of malignant disease in larynx, ii. 771.
 auricle, i. 141-143.
 effect on ear, i. 558.
 on internal ear, i. 527.
 on middle ear, i. 381.
 hereditary, effects on middle ear, i. 388-393.
 larynx, ii. 813-825.
 nasal cavities, ii. 20-23.
 naso-pharynx, i. 705-715.
 nose, i. 705-715; ii. 187-191.
 acquired, i. 709, 710.
 hereditary, i. 705-709.
 primary, i. 709.
 tertiary form, i. 710, 711.
 treatment, i. 711-715.
 Syphilitic otitis externa diffusa, i. 186-190.
 pharyngitis, ii. 292-298.
 diagnosis, ii. 293, 294.
 Syphilitic pharyngitis, prognosis, ii. 295.
 symptoms, ii. 293.
 treatment, ii. 296-298.
 stenosis of larynx, ii. 744-747.
 Syringes, i. 598, 599.
- T.
- Tamponing posterior nares, i. 609, 610.
 Tampons, medicated, for nose and throat, i. 809.
 Teeth, diseases of, effects on middle ear, i. 396-401.
 in chronic catarrh of middle ear, i. 326.
 Teething, acute purulent otitis media from, i. 312.
 effect on ear, i. 274.
 Tegmen mastoideum, i. 5, 12.
 tympani, i. 12, 14, 27.
 Telangiectasis of the nose, ii. 191.
 Telephone as test of hearing, i. 98.
 Temperature-lines in intra-cranial sequelæ of chronic purulent otitis media, i. 462.
 Temporal bone, i. 1-33.
 articulation, i. 1.
 auricular fissure, i. 4.
 caries, i. 454.
 development, i. 26, 32.
 digastric fossa, i. 4.
 fasciæ of petrous part, i. 32.
 fresh human, i. 32.
 Glaser, fissure of, i. 3.
 inner surface, i. 2.
 internal structure, i. 18.
 mastoid foramen, i. 4.
 portion, i. 4.
 process, i. 4.
 mastoideo-squamous suture, i. 4.
 neuralgia from nasal disease, ii. 156.
 occipital groove, i. 4.
 os epitympanicum, i. 29.
 outer surface, i. 2.
 petro-mastoid, i. 26.
 petrous portion, i. 8.
 squama, i. 26.
 squamous portion, i. 2.
 tympanic bone, i. 26.
 zygomatic process, i. 2.
 Tensor palati, i. 65.
 tympani, i. 57, 58.
 in chronic aural catarrh, i. 343.
 mucous fold, i. 55.
 physiology, i. 87.
 tendon, i. 19.
 tenotomy of, in chronic aural catarrh, i. 368.
 vertical fold, i. 56.
 Tests of
 hearing, i. 92-98.
 acoumeter, i. 94.
 Cheval's electro-acoumeter, i. 98.
 consonants, self-sounding (Wolf), i. 97.
 electrical, i. 98.
 expressions for, i. 93.
 Galton's whistle, i. 96.
 in children, i. 537-539.
 in chronic aural catarrh, i. 353-356.
 König's rods, i. 95.
 logographic value of consonants (Blake), i. 96.
 maximal phonometer, i. 96.
 phonograph, i. 98.
 pneumatic, in chronic aural catarrh, i. 358-359.
 Rinne's method, i. 98, 355, 356.
 speech, i. 96-98.
 telephone, i. 98.
 tuning-fork, i. 94.
 watch, i. 94.

- Tests of hearing, Weber's method, i. 98.
whispers, i. 97.
- Therapeutics, local, in diseases of the nares,
naso-pharynx, and larynx, i. 593-611.
- Thorner, Max, A.M., M.D., on acute pharyn-
gitis, ii. 250-274.
- Thrombosis of brain sinuses, effects on eye, i.
553.
and jugulars, i. 458-460.
- Thudichum's douche, i. 598.
- Thyro-arytenoid ligaments, ii. 203.
- Thyro-epiglottic ligament, ii. 202.
- Thyro-hyoid ligament, ii. 201.
ligaments, lateral, ii. 201.
membrane, ii. 201.
- Thyroid cartilage, ii. 199.
- Tic douloureux, ii. 131-133.
reflex nasal, ii. 131-133.
- Tinnitus aurium, i. 276.
in chronic aural catarrh, i. 348-350.
- Tongue-depressor, folding, i. 582.
Sass's, i. 582.
White's self-retaining, i. 586.
- Tonsil, benign tumors, ii. 610-613.
calculi, ii. 598.
chronic abscess of, ii. 595, 596.
foreign bodies in, ii. 598, 599.
hypertrophy of the pharyngeal, i. 648-655.
lupus, ii. 607-610.
malignant disease, ii. 613-621.
mycosis of, ii. 596-598.
of Luschka, i. 573; ii. 195.
pharyngeal, i. 574.
syphilis, ii. 600-603.
tuberculosis, ii. 603-607.
- Tonsillitis, acute, ii. 274-284.
diagnosis, ii. 279, 280.
etiology, ii. 274, 275.
pathology, ii. 278, 279.
prognosis, ii. 280, 281.
symptoms, ii. 276-278.
treatment, ii. 281-283.
- Tonsils, ii. 194, 195.
adherent, ii. 574.
chronic inflammation, ii. 571-595.
adenoids in vault of pharynx, ii.
578.
aural disturbance from, ii. 576, 577.
lymphatism, ii. 578.
respiratory neuroses from, ii. 576.
treatment, surgical, ii. 580-595.
anæsthetics, ii. 593-595.
cold-wire snare, ii. 582.
cutting operations, ii. 586-
595.
"electro-cautery dissec-
tion," ii. 581, 582.
electrolysis, ii. 579.
enucleation, ii. 582.
galvano-cautery, ii. 581.
hemorrhage from cutting,
ii. 586-591.
ignipuncture, ii. 581.
Knight's electric snare,
ii. 584, 585.
tonsil compressor, ii. 590.
tonsillotome, Mackenzie's,
ii. 592.
Wright's electric amygdalotome, ii. 584.
- clinical groups of disease, ii. 574-576.
enlarged, effects on health, ii. 577-579.
treatment, ii. 579-595.
- flat, ii. 574.
hypertrophied, ii. 571-595.
lacunæ of, ii. 194.
large, ii. 573.
- Tonsils, parasites in, ii. 599, 600.
phonatory disturbances in disease, ii. 576,
577.
varieties of inflammation, ii. 571-574.
- Toynbee's otoscope, i. 115.
- Trachea, foreign bodies in, ii. 500-533.
- Tracheotomy, ii. 396-401.
after-treatment, ii. 406-408.
causes of death, ii. 410.
cellulitis, ii. 405.
choice of operation, ii. 401.
complications affecting wound, ii. 409.
diphtheritic infection of the wound, ii. 405.
emphysema, ii. 405.
feeding patients, ii. 409, 410.
high operation, ii. 401-403.
laryngo-tracheotomy, ii. 403.
low operation, ii. 403, 404.
rapid, ii. 406.
removal of canula, ii. 408, 409.
secondary hemorrhage, ii. 405.
value of, ii. 410, 411.
without a tube, ii. 405.
- Trachoma from nasal disease, ii. 160.
from ozæna, ii. 159.
of vocal cords, ii. 473.
- Tractus spiralis foraminulentus, petrous bone, i.
11.
- Tragus, i. 33.
anomalies of, i. 124.
- Transfixion-needles, nasal hypertrophies, ii. 45,
47.
- Traumatic laryngitis, ii. 479-481.
- Tubercle, anterior tympanic, i. 28.
miliary, of larynx, ii. 794.
posterior tympanic, i. 28, 29.
- Tubercular infiltration of epiglottis, ii. 799.
stenosis of larynx, ii. 747.
ulceration of larynx, ii. 796.
- Tubercule in leprosy of larynx, ii. 453.
in lupus of larynx, ii. 430, 431.
- Tuberculoïdin in tuberculosis, ii. 810.
- Tuberculosis, acute, of larynx, ii. 793.
effect on ear, i. 556.
on internal ear, i. 526.
nasal cavities, ii. 23, 24.
of antrum, i. 756.
of larynx, ii. 792-812.
of nose, i. 702-705.
- Tuberculous chondritis of larynx, ii. 802.
infiltration of larynx, ii. 800.
meso-arytenoid infiltration, ii. 801.
perichondritis of larynx, ii. 802.
polypoid excrescences in larynx, ii. 802.
ulceration of vocal bands, ii. 801.
- Tumor, pearly, of middle ear, i. 446.
- Tumors of antrum, i. 756.
benign, of auricle, i. 156-162.
malignant, of auricle, i. 162-165.
nasal cavities, history, ii. 2-4.
- Tuning-fork, i. 94, 95.
Gellé's method, i. 95.
test in chronic aural catarrh, i. 354-356.
- Turbinated bone, fourth, i. 564.
inferior, i. 563.
middle, i. 563.
superior, i. 564.
- Tympanic cavity, i. 13-60.
anterior wall, i. 14.
blood-supply, i. 59.
canal of Huguier, i. 15.
diameters, i. 13.
extrinsic muscles, i. 57.
floor of, i. 14.
Glaserian fissure, i. 15.
inner wall, i. 16.
intrinsic muscles, i. 57.

- Tympanic cavity, lymphatics, i. 60.
 mucous membrane, i. 51.
 nerves, i. 59, 60.
 in and about, i. 79-82.
 outer wall, i. 15.
 posterior wall, i. 15.
 veins, i. 59.
 muscles, in facial paralysis, i. 59.
 nervous supply, i. 57.
 plate, i. 28.
 plexus, i. 16, 82.
 ring, ossification, i. 28.
 Tympanum, *see* Tympanic cavity, i. 13-60.
 Typhoid fever, ear-disease in, i. 558.
 effect on internal ear, i. 526.
- U.**
- Umbo of membrana tympani, i. 44.
 Uterine reflex neuroses of larynx, ii. 694-698
 Utriculus, membranous labyrinth, i. 67.
 Uvula, ii. 193.
 club-shaped, in tuberculosis, ii. 805.
 Uvulae, azygos, ii. 193.
 Uvulitis, ii. 260.
- V.**
- Valsalva's inflation, i. 112.
 Vapors, injection of, in chronic aural catarrh,
 i. 367.
 use of, in otitis media acuta, i. 299.
 Variola, pharynx and larynx in, ii. 633-637.
 Velum palati, ii. 193.
 Ventricles of Morgagni, ii. 203.
 Ventricular bands, larynx, ii. 203.
 Vertigo, aural, i. 531, 533.
 from nasal disease, ii. 135-136.
 in chronic aural catarrh, i. 350, 351.
 laryngeal, ii. 678-683.
 reflex nasal, ii. 135, 136.
 Vestibule, i. 23.
 crista vestibuli, i. 23.
 fovea hemi-elliptica, i. 23.
 macula cribrosa, i. 23.
 pyramidal eminence, i. 23.
 recessus cochlearis, i. 23.
 Vidian nerve, i. 81, 82.
 Visual field, limitations of, from nasal disease,
 ii. 157.
 narrowing of, from nasal disease, ii.
 155, 156.
 Vocal bands, true, ii. 203, 204.
 cords, false, ii. 203.
 in phonation, ii. 220-234.
 nerve-supply, ii. 219.
 tension of, ii. 210.
 trachoma of, ii. 473.
 true, ii. 203, 204.
 culture and hygiene, ii. 212-247.
 chest-capacity, ii. 238, 239.
 correction of vocal defects, ii. 247-
 249.

- Vocal culture and hygiene, essentials of vocal
 culture, ii. 214-217.
 female larynx, ii. 218.
 history of music, ii. 212, 213.
 hygiene of voice, ii. 241, 247.
 male larynx, ii. 218.
 mouth, training of, ii. 239, 240.
 muscles of larynx, ii. 220-225.
 musical ear, ii. 214.
 nerve-supply of vocal cords, ii. 219.
 palate as resonator, ii. 240, 241.
 phonation, ii. 225-239.
 physiology of voice, ii. 217-241.
 pitch, ii. 216.
 production of musical tones, ii. 225-
 239.
 quality, ii. 216.
 resonators, mouth and palate, ii.
 235-237.
 rules for development of voice, ii.
 237-241.
 stammering, ii. 247, 248.
 stuttering, ii. 247, 248.
 vocal cords in phonation, ii. 220-
 234.
 defects and their correction, ii.
 247-249.
 voice-cultivation, ii. 214.
 voice in speaking, ii. 243-247.
 defects and their correction, ii. 247-249.
 processes, ii. 200.
 Voice, hygiene, ii. 241-243.
 in nasal disease, i. 587.
 intensity, ii. 210.
 in speaking, ii. 243-247.
 physiology, ii. 217-241.
 pitch of voice, ii. 210.
 quality, ii. 210.
 rules for developing, ii. 237-241.
 singing, ii. 211.
 timbre, ii. 210.

W.

- Wagner, Clinton, M.D., on local therapeutics in
 diseases of the nares, naso-pharynx, and
 larynx, i. 593-611.
 Watch for test, i. 94.
 Weber's method, i. 93.
 Whisper as test of hearing, i. 97.
 White, Joseph A., A.M., M.D., on neuroses of
 the nose and naso-pharynx, ii. 90-148.
 Whooping-cough, effect on ear, i. 559.
 Wounds of auricle, i. 145-148.
 Wright's electric amygdalotome, ii. 584.
 Wrisberg, cartilages of, ii. 199, 201, 203.

Z.

- Zona pectinata, cochlea, i. 73.
 perforata, cochlea, i. 73.
 tecta, Corti's organ, i. 73.
 Zygotoma, i. 3.

